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ORTHOPEDIC APPLIANCES IN THE REHABILITATION OF PATIENTS WITH SPINAL-CORD INJURIES*

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A REVIEW of the literature dealing with the orthopedic treatment of spinal-cord injuries is remarkable chiefly for the scarcity of available reference. This deficiency is easily understandable in view of the fact that it was only with the advent of World War II that the medical profession was faced with the problem of treatment of a large group of patients with these injuries. Such cases occur sporadically in civilian life, but it is unusual for a large number to be grouped on a service devoted entirely to the treatment of problems peculiar to this type of injury. A considerable number of spinal-cord injuries, with resulting paraplegia, were incurred in World War I, but survival was the exception rather than the rule. The average length of life after such injuries is reputed to have been approximately three weeks, death being due in the majority of cases to sepsis in patients who survived initial shock. With the advent of chemotherapy, air evacuation and improved methods of treatment of shock, a high percentage of such casualties in World War II were saved for rehabilitation to a useful life. Most references and standard texts on orthopedic appliances have only an indirect bearing since they are concerned with allied but not identical problems. The long, double-upright brace for the leg is discussed by Jordan,[1] but the concern is primarily with its use as a weight-bearing appliance rather than one designed only for splinting action as it is used in the treatment of paraplegic patients. A direct reference in the recent literature is that of Kuhn,[2] who mentions the brace problem in a general review of the care of such cases.

The problems presented by the paraplegic patient are unique in many ways, and one of the most important is that of braces. Proper bracing is the cornerstone on which the ambulation program is built; and ambulation plays a vital part in any comprehensive program designed to return such a patient to his rightful place in society. Before the factors involved in choosing the proper brace for an individual case are considered, it is necessary to establish the point in the patient's progress where braces are indicated. This turning point marks the transition from the wheelchair mobility to ambulation requiring full use of all remaining voluntary muscular power. On the Neurosurgical Service, Cushing Veterans Administration Hospital, organized generally along the lines of the Munro classification, braces are not fitted until the patient has entered Stage III. In Stage I (spinal shock), emphasis is placed on the treatment of the original injury, treatment and prevention of decubitus ulcers, bladder care, maintenance of good nutrition and intensive physiotherapy. In Stage II (diagnostic and reparative surgery) surgical procedures indicated in complications frequently incident to spinal-cord injuries are carried out. At that time, surgical closure of decubitus ulcers is done, and necessary genito-urinary surgery is completed. Bladder training, designed to give the patient twenty-four-hour bladder control, is carried on simultaneously and is usually completed at the end of this stage. In cases in which deformities develop despite all preventive measures, corrective orthopedic procedures are carried out. Of equal importance to future efficient ambulation are neurosurgical procedures designed to relieve uncontrolled muscle spasm. The importance of the proper treatment of spasm has been pointed out by a number of investigators and cannot be overemphasized. The paraplegic patient, deprived of most or all of his postural reflexes,[3] must develop through prolonged instruction and practice a new system of balance maintenance. This system is based on voluntary changes of posture designed to distribute body weight equally around the vertical axis of the skeletal system. The art of balance maintenance in sitting and standing is the first and basic phase of ambulation training, and upon its acquisition depends the entire success of subsequent ambulation instruction. The spasm of an even

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moderately well developed mass reflex, particularly in injuries of the thoracic and cervical cord, renders this goal unattainable. The sudden, unpredictable stretch reflexes cause flexion or extension of the lower extremities and trunk, with precipitate loss of balance. The result is either a fall or a rescue by the instructor, which offers a psychologic and mechanical hindrance to ambulation progress. Decubitus ulcers, an ever-present threat in paraplegic patients, frequently result when braces are forced on a markedly spastic subject. Evaluation of numerous agents and procedures for relief of spasm employed on 200 patients treated on this service over the past year indicate that the treatment of choice is the anterior rhizotomy described by Munro.[4] With proper indications, complete rhizotomy is done on complete cord lesions, and differential rhizotomy is done on partial cord lesions.

TABLE 1. *Correlation between Injury Level, Resulting Muscle Deficit and Indicated Type of Brace (Adapted from Morris[8]).*

Approximate Cord Segments	Muscle Group	Chief Muscles	Segmental Innervation	Type of Brace
C1–T1	*Neck* All movements	All muscles	XI C1–C8	Same except for additional special upper-extremity braces
	Pectoral girdle All movements	All muscles	C3–C8	
	Arm, flexion	Coracobrachialis	C6–C7	
		Biceps	C5–C6	
		Brachialis	C5–C6	
	Arm, extension	Triceps	C6–C8	
		Anconeus	C7–C8	
	Forearm and hand All movements	All muscles	C6–T1	
T1–T6	*Thoracic cage* Extension — lateral Flexion	Intercostals	T1–T12	
		Longissimus dorsi	T1–T12	
		Iliocostalis dorsi	T1–T12	
		Spinalis dorsi	T6–T9	
	Pelvis and lumbar spine Flexors	Rectus abdominis	T6–T12	
		External oblique	T6–T12	
		Internal oblique	T10–L1	
		Transversus abdominis	T7–L1	
L1–L4 (5)	*Pelvis and lumbar spine* Extensors; also act as lateral flexors.	Iliocostalis lumborum	L1–L4	
		Longissimus dorsi	L1–L5	
		Quadratus lumborum	L1–L4	
	Thigh, flexors	Psoas major and minor	L1–L4	
		Iliacus	L2–L4	
		Sartorius	L3–L4	
		Quadriceps femoris	L3–L4	
	Thigh, extensors	Gluteus maximus	L5–S2	Long leg brace with back brace
		Biceps femoris	S1–S3	
		Semitendinosus	L5–S2	
		Semimembranosus	L4–S1	
L4–S3	*Thigh* Internal rotators	Pyriformis	S1–S2	Long leg brace with pelvic band
		Gluteus minimus	L4–S1	
		Rectineus	L2–L3	
	Thigh External rotators	Gluteus maximus	L5–S2	
		Obturator internus	L5–S2	
		Obturator externus	L3–L4	
		Quadratus femoris	L4–S1	
		Tensor fasciae latae	L4–S1	
	Thigh Adductors	Adductor magnus	L3–L5	
		Adductor longus	L2–L3	
		Pectineus	L2–L3	
		Gracilis	L2–L4	
	Thigh Abductors	Pyriformis	S1–S2	Long leg brace
		Gluteus medius	L4–S1	
		Gluteus minimus	L4–S1	
		Tensor fasciae latae	L4–S1	
	Leg, flexors	Biceps femoris	S1–S3	
		Semitendinosus	L5–S2	
		Semimembranosus	L4–S1	
		Sartorius	L2–L3	
	Leg, extensors	Quadriceps femoris	L3–L4	
	Foot, plantar flexors	Gastrocnemius	S1–S2	Double upright drop-foot brace with drop-foot spring
		Soleus	L5–S2	
	Foot, inverters	Flexor digitorum longus	L5–S1	
		Flexor hallucis longus	L5–S2	
		Tibialis posterior	L5–S1	
	Foot, dorsiflexors	Tibialis anterior	L4–S1	Wire drop-foot brace
		Extensor digitorum longus	L4–S1	
		Extensor hallucis longus	L4–S1	
	Foot, everters	Peroneus longus	L4–S1	
		Peroneus brevis	L4–S1	
		Peroneus tertius	L4–S1	

With these complications successfully treated, the patient is passed to Stage III (wheel-chair ambulation). It is in this relatively brief stage that the patient should first be measured for braces. Premature measurement may result in needless expense in brace alterations occasioned by changes in the nutritional status during Stages I and II. A contour tracing is made of the parts to be braced with the patient lying on a flat surface and supplemented by circumferences of extremities and trunk. The prescribed brace is then given to the patient, and he is instructed in its application in bed. When this is learned together with other basic elements of self-care, the patient is deemed ready for beginning ambulation training.

A basic premise must be borne in mind regarding the factors involved in choosing the proper brace for a given patient: the function of the brace is not the support of body weight but the maintenance of normal postural relations through splinting action. In effect, the muscle groups responsible for maintaining the body in an erect, stable position are replaced by external mechanical supports, with maximum retention of normal joint function. Three chief factors may be mentioned. The first is the level of the injury, which is usually the most important single criterion for determining the type of brace that the patient will need. When the optimal stage for brace fitting described above has been reached, there is usually a close correlation between the level of injury and the type of brace indicated. Unless otherwise indicated, all levels in the following discussion are dermatome levels. A summary of these data is presented in Table 1. In most cases the type of brace needed may be accurately determined in advance by careful muscle analysis to ascertain the existing deficit. Such tests should be done at regular intervals during the course of rehabilitation as an index of improvement, particularly in partial lesions of the cord and cauda equina. Minor variations may be indicated, and the patient must be observed in all phases of ambulation training for a proper decision to be reached. These are usually variations on a single category of brace rather than between categories — such as changes in the construction of back brace. The second factor is the severity of the injury: whether a partial or complete lesion of the cord or cauda equina. Selection of braces for complete lesions is relatively simple, but partial lesions present a greater problem since the level of injury cannot be closely correlated with the type of brace indicated. For example, a patient with a partial cord lesion at the fifth cervical segment may require a double upright leg brace with a drop-foot spring on the right, and a simple wire drop-foot brace on the left. These situations must be met individually on the basis of thorough muscle analysis and clinical observation of the patient in ambulation; the appliance that most nearly replaces the existing deficit is then chosen. The third consideration comprises malformations that may be present. Most of them will be prevented or corrected surgically during the first three stages of rehabilitation, but prolonged conservative therapy may be the treatment of choice. After relief of spasm, mild hip contractures and scolioses, to mention two examples, may demand some special brace to permit corrective exercises and ambulation. These occasional complications seldom change the over-all requirements of a given patient but can be met with adjustments within a basic brace pattern.

Types of Braces

Drop-Foot or Short Leg Brace (Fig. 1)

The specifications for the drop-foot brace are as follows:

Wire drop-foot brace. Upright supports of 22-gauge spring steel wire are attached to the shoe, with a lightweight stirrup or pinion through the heel. The calf band is of 17-gauge spring steel, with $\frac{3}{16}$-inch sheet of sponge-rubber padding, covered with a calf-skin, single strap and buckle. The weight of the brace with a shoe is 1 pound, 12 ounces, and the total weight is 3 pounds, 8 ounces.

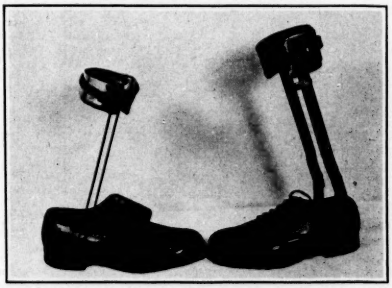

Figure 1. *Wire Drop-Foot Brace (Left). Double Upright Drop-Foot Brace (Right).*

Double upright drop-foot brace. Steel uprights, $\frac{5}{8}$ by $\frac{3}{16}$-inch, are used, with a calf band and strap similar to that of the wire drop-foot brace. A drop-foot spring is applied across a semihinged-type ankle joint, stirrup shoe attachment. The weight of the brace with a shoe is 3 pounds, and the total weight is 6 pounds.

Indications. Analysis of the muscles involved in control of the foot (Table 1) indicates that loss of function below the knee results from an injury to the lowest lumbar cord segments, conus or cauda equina, or all three, that involves all or part of the fourth

lumbar through the second sacral segments. Paralyses of this type are almost invariably flaccid, with considerable muscle atrophy due to damage of either the anterior-horn cell in the fourth lumbar through the second sacral segments, or to transections of all or part of the filaments of the cauda equina. Spasm is rarely a problem. This injury has been most frequently seen in patients with partial lesions of the conus and cauda secondary to penetrating

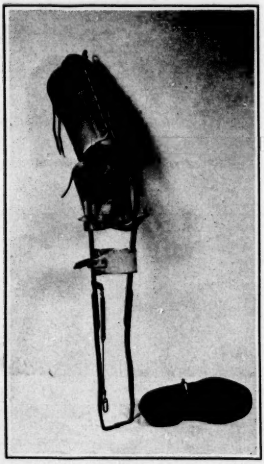

FIGURE 2. *Caliper Long Leg Brace with Detachable Drop-Foot Spring.*
Note instep bar and removable slotted plate.

wounds at or below the first lumbar vertebra. In such involvement, the function of the brace is to substitute a compensatory force for the lost dorsiflexors of the foot and, if necessary, to stabilize the ankle. The loss of the tibialis anterior, extensor digitorum longus and extensor hallucis longus will result in a drop foot with little change in ankle stability (Table 1). Such patients are adequately supported with the wire drop-foot brace, since no lateral stabilization of the ankle is required. In cases in which there is complete loss of all muscle activity below the knee, stabilization of the ankle is desirable, since such activity is normally chiefly dependent on the interaction of the muscle groups of the lateral and posterior aspects of the leg. This is best done with the double upright drop-foot brace, which provides good bilateral support of the ankle joint and positive spring drop-foot correction. In an effort to reduce the weight of the brace, the medial upright support was omitted experimentally. The resulting abduction and eversion deformity of the foot with incomplete ankle stabilization caused us to discontinue its use. It is mentioned only for the sake of completeness and condemnation.

Long Leg Braces (Fig. 2 and 3)

The specifications of long leg braces are as follows:

Caliper with detachable drop-foot spring. Uprights, $\frac{5}{8}$ by $\frac{3}{16}$ inch, steel drop-ring lock; a hinged knee joint and calf and thigh bands of 17-gauge spring steel, padded with $\frac{3}{16}$-inch sheet sponge rubber, covered with calfskin. The ankle joint is a caliper with a detachable drop-foot spring. The drop-foot spring, with the standard attachment above, is attached below to a steel instep bar, $\frac{3}{16}$ by $\frac{3}{8}$ inch, by means of a detachable slotted plate fitting over a button forged on the

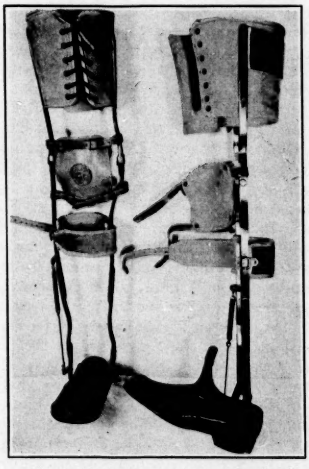

FIGURE 3. *Long Leg Brace with Hinged Ankle Joint and Stirrup Attachment.*
Drop-Foot Spring and Shoe Permanently Attached.

end of the instep plate. The weight of each brace with a shoe is 5 pounds, 8 ounces, and the total weight of both braces with shoes is 11 pounds.

Long leg brace with hinged ankle joint and stirrup attachment. Uprights, $\frac{5}{8}$ by $\frac{3}{16}$ inch, steel hinged knee joint, with a drop-ring lock. Calf and thigh bands are of 17-gauge spring steel padded with $\frac{3}{16}$-inch sheet sponge rubber, covered with calfskin; the drop-foot spring is permanently attached above and below on either side of a semi-hinged ankle joint. The weight of the brace with a shoe is 5 pounds, 8 ounces, and the total weight is 11 pounds.

Indications. The chief single indication for this type of brace is loss of stability of the knees. This added factor marks the distinction between the functions performed by this brace and those of the double upright drop-foot brace. The ability to maintain the legs in extension and consequently to maintain the body in erect posture is directly dependent upon the integrity of the quadriceps femoris muscle (Table 1). Should muscle analysis and the clinical test of having the patient stand erect indicate that the activity of the muscle is lost or so weakened as to render extension of the leg inadequate, this function must be replaced by the long leg brace. These lesions occur predominantly in the lumbar cord segments, but may be due to severe or complete transections of the cauda equina at or below the level of the third lumbar vertebra. Any remaining flexors of the leg are necessarily denied their normal action at the knee by the locked knee joint and are not of primary importance in determining the type of brace used for injuries of this level. Their importance, as is any remaining function of the quadriceps femoris muscle, is in determining the type of gait the patient will use. This brace enables the patient with complete or partial loss of function from the third lumbar through the fifth sacral segment to stand erect and subsequently to learn the gait best suited to his injury. The two types of long leg brace are presented because of their relative merits and disadvantages. The first, with a detachable drop-foot spring, was devised in an effort to overcome the difficulties imposed by the caliper-stop brace while retaining the advantage of a detachable shoe. The caliper-stop brace, particularly with heavier patients and those actively engaged in ambulation, is often subject to having the drop foot recur owing to posterior bending of the stops. All the ambulation gaits, particularly the swing through, tend to cause forcible plantar flexion of the foot, stress being exerted on the stops. Similar tension is exerted when the patient ascends stairs and other obstacles, when during the course of the ascent, the toe of the foot is caught temporarily under a protruding ledge. The detachable drop-foot spring is fastened permanently above but is attached below by the slotted plate to the protruding button on the shoe after the calipers are inserted. The positive tension exerted by the properly adjusted drop-foot spring allows normal plantar flexion of the foot and has proved more effective than stops in correcting the drop foot. The spring should be parallel to its supporting lateral upright to reduce the tendency to eversion and abduction of the foot, which may result if the mechanical advantage is too great. Furthermore, the spring must be properly adjusted to prevent over-correction. The chief advantages derived are the convenience in application and removal, without the necessity of removing the shoes, and continued drop-foot correction. The advantage of the second type of brace is the slight increase in lateral stability of the ankle with the same good drop-foot correction. The hinge may be so constructed as to allow plantar flexion of the feet. The obvious disadvantage of this brace is the greater difficulty of application and removal and the necessity for removing shoes and braces simultaneously. In the use of either of these braces, three points of clinical importance should be emphasized. The hinged ankle joint should be placed 1 cm. above the tip of the lateral malleolus in line with the transverse axis of the talotibial joint. The knee joint should be placed opposite the midpoint of the medial and lateral condyles of the femur (the points of emergence of the transverse axis of the knee joint).

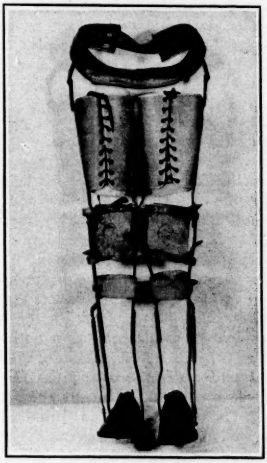

FIGURE 4. *Long Leg Brace with Pelvic Band. Hip joint is a freely movable hinge. Construction of the brace is the same as that in Figure 2.*

If the knee joint is placed too high, it will be noted on sitting that the thigh bands are displaced anteriorly and tend to cut into the soft tissues of the posterior surface of the thigh. The reverse is true when the joints are too low. Lower ends of the uprights that are excessively high may tear the patient's clothing when worn under street clothes. There is a tendency, though less marked, for similar pressure to be exerted on the leg with a displaced hinged ankle joint. Care should be exercised in determining the height of thigh bands, since excessive height may cause the formation of decubitus ulcers over the ischial tuberosities and undue pressure on the perineum and genitalia. The superior edge of the band should be parallel to the inguinal

ligament and just low enough to clear those vulnerable structures.

Long Leg Brace with Pelvic Band (Fig. 4)

The specifications of the long leg brace with pelvic band are as follows:

Long leg braces with uprights of 5/8-by-3/16-inch steel. The upright of the pelvic-band attachment is made of 5/8-by-3/16-inch steel, with calf, thigh and pelvic bands of 17-gauge spring steel, padded with 3/16-inch sheet sponge rubber covered with calfskin. The ankle joint is of the caliper type, the knee joint a drop-ring lock-hinge joint, and hip joint a free hinge joint allowing anteflexion and retroflexion at the hip. The drop-foot spring is fixed above and is detachable at the shoe by means of a slotted plate over the button of the instep bar. The pelvic band is secured by a single padded leather strap. The weight of the brace with shoes is 12 pounds, 9 ounces.

Indications. Analysis of component parts of this brace indicates that the only additional feature, compared with the long leg brace, is the pelvic band. This is attached by an increase in the length of the lateral uprights of the long leg braces and fastening of the band uprights with a freely movable hip joint. No lock is attached. Its adoption for the paraplegic patient is based on specific indications. The level of the injury (Table 1) corresponds roughly to the same level indicating the double upright long leg brace described above. Injuries from the third lumbar segment or cauda equina, or both, that are so complete as to deprive the patient of the functions discussed above under the indications for the long leg brace will in some cases require the pelvic-band extension. The same foot and ankle support is needed, as well as the capacity to maintain the knee in extension in a standing position. The additional factor involved is the loss of part or all of the function of the internal and external rotators of the thigh. The rotation deformities occasioned by the loss of these muscles comprise the chief indication for the pelvic-band extension. The loss of the external thigh rotators with some remaining function of the internal rotators results in a medial rotation deformity of the lower extremities if long leg braces alone are used. This position renders it difficult for the patient during ambulation to swing through smoothly and to regain balance properly. Conversely, unopposed external rotation of the extremities, with resulting external rotation of the feet, interferes even more with these maneuvers. The specific function of the pelvic band is to correct this muscular imbalance by fixing the lower extremities in the proper anteroposterior alignment of 5° external rotation. As would be expected, no appreciable lateral stabilization of the hips can be obtained with the pelvic band, since the chief point of such instability in high lesions is in the lumbar portion of the spine. It may be possible to determine the need for the addition of a pelvic band only by clinical study of the patient's ability to maintain proper alignment of the lower extremities in ambulation. It is essential that no lock be placed on the hip joint, since the normal hip-joint action must be preserved regardless of the gait used. The hip joint of the brace must be placed at the proper level to obtain maximum function of that joint. Its position should be opposite the superior border of the greater trochanter, which is the point of exit of the transverse axis of the hip joint. When the joint is too high, there is downward traction on the pelvic band, as well as undue pressure on the anterior aspect of the thigh by the thigh band when the patient is in the sitting position. If the joint is placed too low, there is upward thrust on the pelvic band and pressure on the posterior aspect of the thigh. The pelvic band should fall midway between the crest of the ilium and the greater trochanter to avoid pressure over the bony prominences, with possible decubitus-ulcer formation. The comfort of the patient must also be considered with injuries of this level since the sensory level is usually below the point of contact with the band.

Long Leg Braces with Back-Brace Attachments (Fig. 5 and 6)

The specifications of these braces are as follows:

Long leg brace and lateral supports of back brace are of steel, 5/8 by 3/16 inch, with calf and thigh bands of 17-gauge spring steel, a back band of 17-gauge spring steel or duraluminum, padded with a 3/16-inch sponge rubber covered with calfskin. The ankle joint is of the caliper type with detachable drop-foot springs. The knee joint has a drop-ring lock, with a hinge joint, and the hip joint is of the freely movable hinge type; abdominal support is provided by a piece of 11-ounce duck with multiple canvas web straps.

Indications. This type of brace is limited to the highest levels of injury — that is, generally, those above the third lumbar vertebra (Table 1). Its distinguishing feature is lateral hip stabilization by functional replacement of muscle groups controlling the actions of the pelvis and lumbar spine. The degree of impairment of these muscles groups depends upon the level and completeness of the injury. If muscle analysis indicates deficiency of clinical importance, support must be sought to replace the following vital functions: maintenance of erect posture of the trunk, lateral stability of the pelvis and lumbar spine and maintenance of the normal pelvic inclination. The first of these functions is performed by the iliocostalis lumborum, longissimus dorsi and quadratus lumborum, which are pre-

dominantly innervated by the first four lumbar segments. They also act as lateral flexors by contraction of the homolateral group with the simultaneous relaxation of the contralateral group. Although the intrinsic muscles surrounding the hip joints contribute appreciably to pelvic stability, the lumbosacral group appears clinically more important. The flexors of the pelvis and lumbar spine have a dual function to perform and would be completely lost in a lesion at the level of the sixth thoracic segment or higher. They not only are important as flexors of the lumbar spine but also interact with the extensors of the pelvis and lumbar spine to maintain the normal angle of pelvic inclination. This angle, formed between the true conjugate and the horizontal with the patient in the standing position, is normally 50 to 60°. Loss of these two opposed groups results in lumbar lordosis, with marked increase in the angle of pelvic inclination. This lordosis is quite disabling and virtually prohibits the attainment of balance and subsequent ambulation. The back brace is designed to maintain extension of the trunk by articulation with the thoracic cage above and the lateral long leg supports below. The pelvic extension produced by the inferior transverse portion of the back attachment, together with the replacement of the abdominal musculature function by the abdominal support,[6] tends to maintain the normal pelvic inclination. Side sway at the hips is eliminated by the lateral uprights, and thigh flexion and extension are retained through the freely movable, hinged hip joint. The latter action is indispensable in teaching the patient the proper swing through in crutch ambulation. By being allowed free extension at the hip joint, the patient is enabled to balance momentarily with the thighs in slight extension after completing the swing through while lifting his crutches forward to begin the next swing through. The ability to get the hips forward after completion of one swing through in preparation for the next is essential for efficient swing-through ambulation regardless of the type of brace employed.

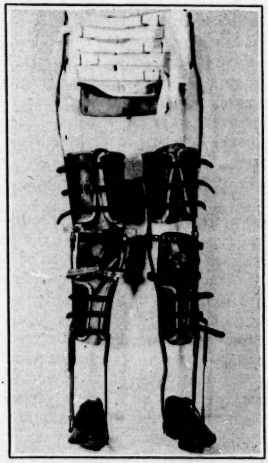

FIGURE 5. *Long Leg Brace with Back Attachment (Front View). Hip joint is a freely movable hinge. Construction of the brace is the same as that in Figure 2.*

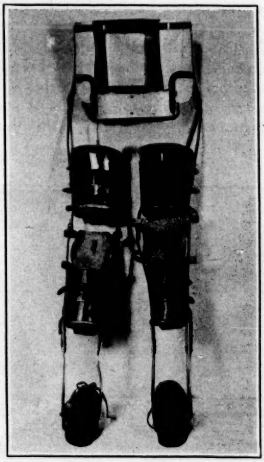

FIGURE 6. *Long Leg Brace with Back Attachment (Rear View).*

It is with the use of this brace that the necessity for proper preambulation therapy becomes most evident. Spasm of muscles acting on the thigh, pelvis and trunk must be relieved. Otherwise, the patient will be subject to sudden "jacking" forward or backward as the result of a mass reflex initiated by stretching of these muscles in the act of swinging. The patient must have completed the basic maneuver of balance, since it is particularly important in lesions of this level that this stability and feeling of confidence be acquired. Should all medical therapy of a well developed mass reflex fail and the patient refuse surgical correction, this type of brace cannot be employed, and consequently the most efficient ambulation cannot be attained. The alternative is the long leg brace with pelvic band *with* hip locks and a wider abdominal support. This combination allows the patient to substitute flexion and

extension in the lumbar spine for normal hip motion while splinted by his spastic muscles. This is not efficient ambulation and is never recommended as the procedure of choice, but only as a last resort under these circumstances.

The height of the back brace has been the subject of much discussion and experiment, but the optimum level has proved to be 4 cm. below the inferior angle of the scapulas. This is sufficiently high to allow good articulation with the lower portion of the thoracic cage and yet low enough to permit free action of the scapulas and other elements of the pectoral girdle. Higher back braces are superfluous since the thoracic cage is well supported structurally by ligaments and the pectoral girdle. A positive objection to braces extending above this point is the interference offered to the proper use of crutches, which become entangled with the back-brace extension. The height has a direct bearing on the total weight, which at best exceeds that of any other type. Attempts to substitute duraluminum for the uprights and transverse struts of the back brace have resulted in failure because of the great stress that the appliance is called on to bear. Some weight may be spared with substitution of sheet duraluminum for the 17-gauge steel in the main body of the back support, but further use of this material is foredoomed to failure.

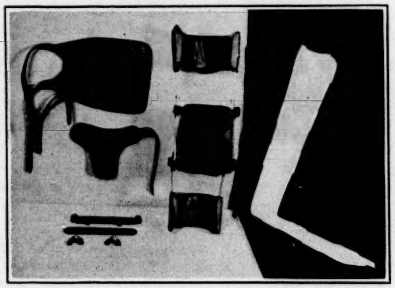

FIGURE 7. *Miscellaneous Braces.*
Upper left, knee strap; middle left, "T" strap; lower left, detachable spreader bar; center, sleeper brace; and right, cock-up splint.

It was primarily for patients with back braces that the caliper with a detachable drop-foot spring was developed, since the stirrup-type leg brace with shoes and back brace attached requires the assistance of one or two persons in application and removal of the unwieldy device. With calipers and a detachable drop-foot spring the patient can wear shoes continually, insert the calipers into the shoes and then proceed to lace the brace from below upward. Unless a caliper lock is employed in addition to stabilize this ankle joint, some stability may be sacrificed. This is justifiable since it means the difference between a brace that is practicable for use and one that is not.

Miscellaneous (Fig. 7)

In patients whose injuries occur above the first thoracic segment, certain special appliances may be made for the arms, depending upon the degree of brachial-plexus involvement. Among these are the triceps brace to maintain the arms in extension and a leather wristlet to maintain wrist stability. The knee strap is used when necessary to prevent genu varus or valgus, and the "T" strap performs a similar function at the ankle joint. The cock-up splint is made of a wire frame with transverse canvas web supports.[7] The sleeper brace and cock-up splints are used in the earlier stages (I and II) before the patient becomes ambulatory as an aid in preventing flexion contractures of the ankle and knee. The detachable spreader bar is occasionally employed in teaching the swing through in Stage IV, but further use is discouraged; it is attached to the medial uprights at ankle level by means of bolts with wing nuts. The Taylor back brace, not shown, is used for correction in the occasional case in which severe kyphosis develops in high thoracic and cervical injuries.

DISCUSSION

It will be noted in the foregoing discussion of the four general types of supports that the indications are based primarily on the assumption of a complete lesion at the level indicated. Although such an injury is actually present in the majority of patients, a smaller proportion of incomplete injuries of the cord and cauda equina will be encountered. In such cases it is impossible to state categorically in advance exactly what type of appliance will be indicated, not only because of wide variance in the initial pattern of muscular dysfunction but also because there may be gradual improvement in muscular power over a period of months after the initial trauma. Muscle analysis is indispensable in partial lesions as the initial step when the patient is ready for bracing. With this information at hand and the specific function performed by each type of appliance borne in mind, a rational approach may be made to the specific problem presented. In cervical-cord injuries the extent of the brachial-plexus involvement will determine the appliances necessary for the upper extremities.

Although a detailed study of ambulation is beyond the scope of this communication, it is essential in any discussion of braces at least to mention the type of gait that may reasonably be employed with a given appliance. Patients requiring only drop-foot braces approach most nearly the normal gait. They may use ultimately either one or two canes and walk

almost normally except that they tend to proceed on a rather wide base with steppage gait. Initially, it may be necessary to train such patients with crutches instead of canes, but the use of crutches should be discouraged as rapidly as possible — the obvious objections to crutches are that they call attention to the patient's handicap and promote a feeling of dependency. The type of gait to be employed by patients with long leg braces will depend on the degree of function remaining in the thigh flexors. Should the thigh flexors be adequate to advance the legs even though not strong enough to support the patient's body weight, either the four-point or the more rapid two-point crutch gait is feasible. In either case, he should also be taught the swing through, which is the most rapid of all gaits and may be required in situations in which speed is desirable, as in crossing streets with traffic lights. This type of gait can be taught to any properly prepared patient with a complete or partial lesion below the first thoracic segment and is mandatory for those with loss of thigh flexors and higher lesions (the second lumbar segment upward). The pelvic-band group will not usually exhibit enough function to allow the two-point and four-point gaits and consequently must be taught the swing through with the preliminary temporary swing-to gait. For patients requiring back braces the only practicable gait for distance walking is the swing through, which is taught to all patients except those with lesions above the second thoracic segment that are so severe as to cause gross impairment of arm function. As in the pelvic band group, the swing to is taught as a preliminary to learning the swing through. The swing to is retained only for maneuvering in close quarters where the lack of space renders the swing through impossible. Since the hip joint must be movable for efficient ambulation, it is incumbent on these patients to exercise more skill and balance than lower injuries demand. The patient should not be permitted to attempt a swing to until he has thoroughly mastered the art of balancing with first one and then the other crutch off the floor, unsupported by either an instructor or other artificial means. The poise and sense of confidence gained thereby is basic in the subsequent steps of ambulation progressing through the swing to to an efficient swing through. Lesions high enough to involve the brachial plexus usually force the patient to walk with a swing to or shuffle. This has proved practicable with one of our patients with a complete motor lesion below the fifth cervical segment except for some intact fibers in the seventh and eighth cervical segments. Concurrently and later, all patients must go through a period of intensive mat work and other calisthenics designed to strengthen the pectoral girdle and arms to a point that will permit the stress of weight bearing demanded for ambulation. This is particularly important in the group with higher injuries.

The knee lock used in construction of the long leg braces is recommended after testing of several more complicated types. It is of simple, rugged construction requiring a minimum of machining and repair. The gravity lock is easily placed and foolproof during use. More elaborate locks are more expensive and prone to damage by twisting or bending.

The width of calf and thigh bands is of practical importance. As a general rule, best results are obtained from narrow bands. Although no difficulties have been encountered, owing to the youth of the patients, circulatory embarrassment may well result in older patients if calf and thigh bands are too wide. This precaution should apply to any patient with venous varicosities, arteriosclerotic changes or other impairment of peripheral circulation.

Steel is the material of choice though its weight is somewhat greater than that of duraluminum. Its durability and capacity to withstand torsion and stress, particularly of the higher braces and in heavy patients, make it irreplaceable by any of the light alloys available. Observations on duraluminum braces constructed here and at other institutions indicate that joints deteriorate rapidly and that twisting necessitates frequent attempts at adjustment, which are rarely, if ever, successful. The calf and thigh bands used on these braces are not of the contour-fitting type advocated by Hessing,[1] since no weight-bearing function is required of them. The considerable time and expense associated with the building of such bands may be avoided.

Summary

Preliminary rehabilitation procedures prior to the fitting of braces on patients with spinal-cord injuries are outlined.

Factors involved in choosing the proper brace for patients with spinal-cord injuries, with special reference to the level of injury, are discussed.

Four main types of brace are presented in detail, with the indications for each.

The type of gait to be expected for each level is described.

I am indebted to Mr. Walter Gavin, of the Orthopedic Shop, Cushing Veterans Administration Hospital, for his co-operation and assistance.

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ULCEROGLANDULAR TULAREMIA TREATED WITH STREPTOMYCIN

A Report of Two Cases

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HEILMAN'S[1] demonstration of the effectiveness of streptomycin against *Pasteurella tularensis* in vitro and in vivo has found application in the treatment of tularemia in man. The cases presented below are considered to be of interest because they report additional experience with the use of streptomycin in the treatment of tularemia. Furthermore, they afford an interesting comparison of the effectiveness of treatment of the acute and chronic phases of the disease.

CASE REPORTS

CASE 1. A 39-year-old man was hospitalized on February 14, 1947, complaining of "cold sensations," pain in the eyes and back and coughing and sneezing of 2 days' duration.

The past history as obtained at the time of admission was of no related significance except for typhoid fever 29 years previously and malaria in 1930.

Physical examination revealed a haggard but well nourished man who appeared moderately ill. The skin was livid.

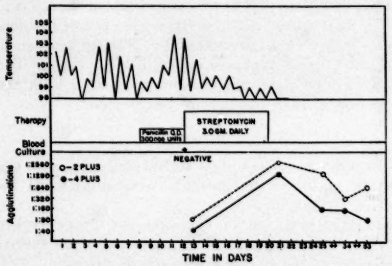

FIGURE 1. *Pertinent Laboratory Data and Clinical Course in Case 1.*

Except for a moderately injected throat and increased breath sounds at the left base, the findings were not remarkable.

On the following day the patient began to manifest a spiking, remittent type of fever. The examining ward officer believed that the patient had a virus pneumonia. When the temperature continued and coarse rales were noted at the left base, previous supportive and symptomatic measures were supplemented by 300,000 units of calcium penicillin in beeswax and peanut oil each day. Despite this therapy the clinical course remained unchanged. Two weeks after admission the examining ward officer first noted an umbilicated, ulcerative lesion with a necrotic center on the dorsal surface of the right middle finger at the distal phalangeal joint, measuring 1.5 cm. in diameter. The edges were raised, erythematous and indurated. A single tender, firm lymph node measuring approximately 3 cm. in its greatest diameter was palpable in the right axilla. The presumptive diagnosis of tularemia was entertained, and corroborative studies were made.

Further questioning revealed that the patient had been rabbit hunting 3 days before admission. He stated he had scratched his right middle finger with a briar, but he had not skinned the rabbits. On the following day a localized area of infection was noted at the site. On the day of admission he experienced chills, fever, headache, general malaise and a tender swelling in the right axilla. He also volunteered the information that "rabbit fever, typhus fever and hemorrhagic fever" were endemic in his home town, Americus, Georgia, the locale of his rabbit hunting. Agglutinations and a culture and smear of the ulcerated area were made, and streptomycin — in a dosage of 3 gm. daily — was given. Treatment was continued for 7 days. Within 24 hours the patient experienced dramatic subjective improvement, and in 48 hours the temperature began to regress and the lesion to undergo involution. At the end of 7 days the temperature became normal and remained so for the duration of the hospital stay of 54 days. The local lesion and axillary adenopathy completely subsided 4 weeks after the institution of streptomycin.

The subsequent clinical course was uneventful. The pertinent laboratory data are summarized below, and the clinical course is graphically represented in Figure 1.

On February 14 examination of the blood disclosed a white-cell count of 12,000, with 70 per cent neutrophils, 23 per cent lymphocytes and 7 per cent monocytes. The urine was normal. The blood Kahn test was negative. On February 25 a blood culture was negative, and smear and culture of the ulcer were negative for *Past. tularensis*; agglutinations for the organisms of typhoid, paratyphoid and undulant fever, as well as those for salmonella and typhus (proteus x 19), were negative. Agglutinations for *Past. tularensis* were ++++ in a dilution of 1:40, +++ in one of 1:80 and negative in one of 1:160. On March 6 the agglutination was ++++ in a dilution of 1:1280, ++ in one of 1:2560 and negative in one of 1:5120. On March 10 the agglutination was ++++ in a dilution of 1:160 and ++ in one of 1:1280. On March 19 the agglutination was ++++ in a dilution of 1:320, ++ in one of 1:640 and negative in one of 1:1280, and on April 7 it was ++++ in a dilution of 1:160, ++ in one of 1:640 and negative in one of 1:1280.

Three x-ray examinations of the chest during the initial 10-day period were negative.

CASE 2. A 26-year-old paratrooper was hospitalized on April 24, 1946. He complained of right axillary and right epitrochlear swelling associated with numbness of the fourth and fifth fingers of the right hand of 2 months' duration. During that time he had lost 17 pounds in weight and had observed that the "swellings" had been increasing in size; at the time of admission they had become painful. The patient had been rabbit hunting in January, previous to and at the time of which he had had a "sore" on the ring finger of the right hand. After he dressed the rabbits the "sore" on the right ring finger became deeply infected, and red streaks extended to the wrist. Two weeks later he experienced chills and fever. After these symptoms had persisted for 1 week, he reported to another Army installation, where he was treated for malaria, the fever persisting for 1 week after hospitalization. On the day of admission he had noted the onset of aching in the muscles and joints.

Physical examination revealed a well developed man, who showed signs of recent weight loss. There were numerous small, nontender shotty lymph nodes in the anterior cervical triangle. In the right axilla there were three tender nodes, which were rubbery in consistence and measured 1 or 2 cm. in diameter. A similar tender right epitrochlear node was present. When palpated, a linear structure that was considered to be the ulnar nerve moved on manipulation of the node and produced a shocking type of ulnar paresthesia. An ulnar hypesthesia of the fourth and fifth fingers was also present. A circular scar, measuring 5 mm. in diameter, was on the medial dorsal surface of the terminal phalanx of the fourth finger of the right hand.

Examination of the blood disclosed a white-cell count of 7500, with 55 per cent neutrophils. A smear was negative for malaria. The urine and the serologic findings were normal. The corrected sedimentation rate was 11 mm. in 1 hour (Wintrobe method). Two agglutinations for *Past. tularensis* were negative. The presumptive diagnosis of tularemia was so strongly held that it was requested that the specimen be sent to the Service Command Laboratory, where agglutinations for *Past. tularensis* were reported ++++ in a dilution of 1:320, and ++ in one of 1:2560. X-ray examination of the chest was negative.

During the hospital stay the patient was afebrile. With the establishment of the diagnosis of tularemia, streptomycin therapy consisting of 0.2 gm. every 4 hours for a total of 4.4 gm. over a 4-day period was instituted. During treatment there was generalized lymph-node enlargement, a 1-cm., nontender right axillary node, several pea-sized, tender left axillary nodes, two pea-sized, nontender right epitrochlear nodes, three similar nontender left epitrochlear nodes and bilateral tender inguinal nodes on the left.

The temperature was 97.6°F., the pulse 80, and the blood pressure 110/85.

The patient remained afebrile throughout the hospital stay. Shortly after admission, the left epitrochlear and left inguinal lymph nodes were surgically removed. The former was extracted and cultured on cystine blood agar. However, no growth was obtained. The inguinal node was sent to the area pathology laboratory, which reported chronic lymphadenitis. X-ray examination of the left hip was negative.

Because of the rise in agglutination titer, as well as the significant change in clinical course, it was believed that the patient was experiencing a relapse. Therefore, on March 4, streptomycin was started, consisting of 3 gm. daily for 7 days in divided doses for a total of 21 gm. At the conclusion of therapy the patient felt markedly improved, and the adenopathy slowly regressed. Previously, he had lost 15 pounds in weight. One month after the conclusion of therapy he had regained 7 pounds. There was no adenopathy, and the agglutination determination was ++++ in a dilution of 1:160 and ++ in one of 1:320. However, the last determinations were ++++ and ++ in dilutions of 1:160 and 1:640 respectively, on May 26. Urinalyses were negative during the period of observation. An electrocardiogram was normal. A bromsulfalein test (5-mg. dose) showed no retention of the dye in 1 hour. The corrected sedimentation rate was 9 mm. in 1 hour (Wintrobe method) on two occasions.

The agglutination determinations are presented in Table 1.

TABLE 1. *Agglutination Determinations in Case 2.*

DATE	AGGLUTINATION							
	1:40 dilution	*1:80 dilution*	*1:160 dilution*	*1:320 dilution*	*1:640 dilution*	*1:1280 dilution*	*1:2560 dilution*	*1:5120 dilution*
4/25/46	Negative							
4/30/46	Negative							
5/6/46	++++	++++	++++	++++	++	++	++	Negative
5/8/46*	++++	++++	++++	++++	++	++	++	Negative
5/24/46	++++	++++	++++	++++	++	++	Negative	
6/3/46	++++	++++	++++	++++	++	++	Negative	
6/19/46	++++	++++	++++	+++	++	++	Negative	
6/26/46	++++	++++	++++	−				
7/25/46	++++	++++	++++	−				
8/8/46	++++	++++	++++	−				
10/22/46	++++	++++	++++	++	++	Negative		
1/7/47	++++	++++	++++	++	+++	+++	−	
2/24/47	++++	++++	++	++	++	Negative		
3/3/47	++++	++++	++++	++	++	Negative		
3/6/47†	++++	++++	++++	++	+	++	Negative	
3/11/47	++++	++++	++++	++	++	Negative		
3/14/47	++++	++++	++++	++	++	Negative		
3/19/47	++++	++++	++++	++	++	Negative		
4/22/47	++++	++++	++++	++	Negative			
5/7/47	++++	++++	++++	++	+	++	Negative	
6/15/47	++++	++++	++++	++	Negative			

*Streptomycin, in total dosage of 4.4 gm., given between May 11 and 15.
†Streptomycin, in total dosage of 12.0 gm., given between March 4 and 11.

there was beginning regression of the lymphadenopathy and diminution in the weakness. One week later all tenderness of the lymph nodes had subsided, but slight residual adenopathy remained. The patient, who was much improved subjectively, was discharged to duty 35 days after admission.

After discharge he was seen periodically as an outpatient. Objective and subjective improvement continued, with complete resolution of the adenopathy and with ability to carry on with military performance. However, he still complained of some weakness and did not completely regain the weight that he had lost.

Determinations of agglutination for *Past. tularensis* were made monthly and remained constantly ++++ in a dilution of 1:160 during the ensuing months.

Except for weakness and nausea following exertion the patient remained well until December. He experienced a mild aching sensation in the left thigh, left leg and left lower quadrant. When he arose each morning associated malaise returned. The symptoms were of gradual onset but increasing severity. On January 6, 1947, he noted for the first time a recurrence of lymphadenopathy in the left epitrochlear region. At the unit dispensary an agglutination for *Past. tularensis* was reported as ++++ in a dilution of 1:1280 — a higher titer than at any time previously or subsequently in the illness. On February 3 the aching pain in the left axilla and left leg became severer. The leg pain apparently originated in the left inguinal region and was associated with left inguinal adenopathy; the pains radiated down the leg, were aggravated by exercise and were relatively constant. A novocain injection into the left groin produced relief for 1 hour. Neuropsychiatric examination revealed no psychoneurotic tendencies.

On February 24 the patient was readmitted to the hospital because of the symptoms and clinical course described above. Physical examination revealed a slightly toxic and chronically but not seriously ill patient.

DISCUSSION

The effectiveness of streptomycin treatment in the cases reported above parallels that which has appeared in the literature to date.[1–12]

Case 1 afforded no particular problem once the diagnosis had been established. The response was excellent, so far as both morbidity and mortality were concerned, and the effectiveness of streptomycin was again demonstrated. Case 2, however, presented a more complex problem.

Several features present themselves for discussion. The effectiveness of streptomycin when latency exists between initial onset of the disease and the institution of treatment does not seem to be en-

hanced. Although the clinical response to streptomycin was definite, the subsequent course of the disease indicates probable inadequacy of dosage initially. It may also indicate decreased effectiveness of treatment when a delay occurs between the initial phase of the disease and the institution of therapy. The recurrence of symptoms associated with variation in serologic titer of significant degree suggests that criteria for chronicity should be extended farther than the number of days of temperature above 98.6°F., the duration of buboes and the number of days in bed, as suggested by Foshay and Pasternak.[6] Evidence for relapse as manifested by serologic and clinical changes may be correlated with the retention of living bacteria within the recovered patient. The inability of streptomycin to effect lasting remission in Case 2 was probably due not only to this fact but also to development of resistance by the organism to the antibiotic agent. The initial amount of streptomycin used may be considered inadequate in the light of current knowledge of organism sensitivity. It is unfortunate that such studies were not available in this case, in which the course of events suggests the importance of early control of the disease before maximum invasion has occurred.

Summary

Two cases of ulceroglandular tularemia treated with streptomycin are presented in which the course paralleled that which has appeared in the literature to date.

The mechanics for failure to effect a lasting cure in one case are discussed.

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THE EFFECT OF SURGICAL OPERATIONS ON THE BROMSULFALEIN-RETENTION TEST*

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THERE are several reports in the literature dealing with the effect of surgical operations on liver function. The available material was recently reviewed.[1,2] Most workers report changes in a high proportion of patients after surgery under general or spinal anesthesia. The hippuric acid test was used in several cases but has been criticized on theoretical grounds. The principal objection is that it depends on the integrity of kidney function, which may be impaired immediately after a surgical operation. Other authors have reported results obtained with the bromsulfalein-retention test using an injection of 2 mg. of the dye per kilogram of body weight.[2] It has recently been shown that the bromsulfalein-retention test is rendered more sensitive by the use of a dose of 5 mg. per kilogram of body weight.[3] Finally, in view of the report that mechanical trauma to the liver may produce impairment of its function,[4] it seemed worth while to evaluate the effect on the liver of extra-abdominal operation so as to exclude the possible factor of mechanical trauma.

The work reported below represents an attempt to detect changes in the function of the liver following extra-abdominal operations by means of the bromsulfalein-retention test modified so as to make it more sensitive.

In addition to this procedure blood was obtained for thymol-turbidity and cephalin-flocculation tests.

Bromsulfalein retention was determined on nonfasting patients according to the method of Mateer et al.,[3] 5 mg. per kilogram of body weight and a thirty-minute period being used. Readings of bromsulfalein retention were made by comparator block§ matching.

The cephalin-flocculation test was done by the method of Hanger,[5] using the Difco reagent. A single twenty-four-hour reading of the reaction was recorded.

In the thymol-turbidity test the technic described by MacLagan[6] was used and the values expressed in cubic centimeters of a suspension of barium sulfate as recommended by Ley et al.[7] The reaction of the thymol reagent as measured by the Beckman electrometer was pH 7.8.

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§Kindly supplied by Hynson, Westcott and Dunning, Philadelphia. With 5 mg. of dye per kilogram of body weight, a correction factor is used in the readings.

Material and Method

A group of 20 patients admitted to the Memorial Hospital for operative treatment was studied. Half the patients (Group I) were on the Head and Neck Service, and the other half (Group II) on the Breast Service. This type of patient was selected to avoid the inclusion of cases in which intra-abdominal procedures had been performed. The possibility of mechanical trauma to the liver was therefore excluded. In each group of 10, the patients were unselected and were studied as they were admitted on the wards.

The state of nutrition of each patient was appraised by means of the history and general appearance, the weight and the detection of clinical signs of nutritional deficiencies. All patients studied were found to be in a satisfactory state of nutrition except 1 (Case 7), who was obese. Clinical evaluation of pre-existing liver damage was done by questioning about the existence of past liver disease, exposure to toxic factors including alcoholism and the detection by physical examination of such signs as enlargement of the liver and spleen, icterus, collateral circulation and spider angiomas. By these criteria, all patients were found to be free of clinically detectable liver disease before and after the operation period except 1 (Case 2), whose liver was slightly enlarged and who had a past history of heavy alcoholic intake.

Two patients, Cases 12 and 14, were found to have high blood pressure on admission. The former had a blood pressure of 170 systolic, 120 diastolic, auricular fibrillation and slight dyspnea on exertion, but no peripheral edema. Functionally she belonged to Group II-C of the classification of the New York Heart Association; her cardiac status was not clinically altered by the operative procedure. The other patient had a blood pressure of 210 systolic, 90 diastolic. Her only cardiac symptom was slight dyspnea on exertion. This case should be considered in Group I-B of the classification of the New York Heart Association; the operation did not alter her cardiac status.

The over-all clinical picture, including the type of operation and its duration, is presented in Table 1. Some patients (Cases 1 to 10) received intravenous pentothal sodium as a general anesthetic; in others (Cases 11 to 20) operation was performed under general anesthesia by nitrous oxide, oxygen and ether. Every patient prior to operation received an injection of 15 mg. of morphine, 0.6 mg. of atropin and 100 mg. of nembutal or 100 mg. of luminal.

In each group the patients were classified according to decreasing severity of operation. Thus in Group I, the most serious operation was performed in Case 1, and the least serious in Case 10. In Group II the most serious operation was performed in Case 11, and the least serious in Case 20. Evaluation of the gravity of the surgical procedure is admittedly arbitrary and was based mainly on two criteria: extent of trauma, with particular emphasis on bone resection, and duration of the procedure. This classification does not pretend to be an absolute one but rather reflects the general trend of severity within each group.

The blood pressure was followed by readings obtained at fifteen-minute intervals during the entire procedure and immediately thereafter. A fall of blood pressure of 20 to 40 for not longer than half an hour was considered a sign of mild shock. A more serious manifestation of shock was not observed. Replacement fluids given in the course of the operation are indicated in Table 1. Fever was absent at the time of operation in all patients.

On admission the bromsulfalein-retention test was carried out, and blood was obtained for the thymol-turbidity and cephalin-flocculation tests. This procedure was repeated within an hour of the patient's return from the operating room. In most cases the patient was still under the influence of the anesthetic when the second test was done. At least a one-day interval separated the preoperative and postoperative tests. The patient was tested again once or twice several days later when he was well on the way to recovery.

Results

Bromsulfalein Clearance

Before the operation the retention of bromsulfalein in all patients did not exceed 10 per cent, with the exception of 1 patient (Case 7), who had a retention of 12 per cent. The upper limit of normal retention of bromsulfalein after thirty minutes with the technic used is 10 per cent, and all patients studied can therefore be considered as having had a normal test preoperatively.

Immediately after the operation, there was a marked elevation of the amount of bromsulfalein retained in the blood in several patients: the increased retention could be considered significant in Cases 1 to 9, 11, 12, 14, 15 and 16. The elevation was absent or insignificant in the others. The increased retention was pronounced in 6 cases in Group I (Cases 1, 2, 3, 5, 7 and 8), the greatest retention being observed in Case 8, and in 2 patients in Group II (Cases 11 and 12). The increased retention was not maintained, and the test returned toward normal in the following days.

Thymol Turbidity

The usually accepted upper limit of normal with this test is a turbidity corresponding to 1.75 cc. of barium sulfate suspension. Four of the 20 patients initially had a somewhat elevated test (Cases 1, 11, 14 and 20). There was no general increase after the operation. One patient (Case 7) showed a

significant increase. In the others the thymol turbidity either remained unchanged or decreased.

Cephalin Flocculation

A normal test is represented by absence of flocculation (0) or a + reaction. Five patients (Cases 1, 4, 5, 8 and 10) had an abnormal flocculation test preoperatively. The change in cephalin flocculation postoperatively was not consistent, increasing in some patients and decreasing in others. Most patients in Group II, with the exception of Case 19, had a normal cephalin flocculation initially, which remained normal postoperatively.

In Group I there was no absolute correlation between the severity of the operation and the amount of dye retained postoperatively. For instance, the patient (Case 8) whose operation was considered less severe than that on the 7 patients preceding her in the classification of Table 1 had the highest degree of retention. In Group II the correlation was better, since the greatest retention of dye was observed in the first patients of the group (Cases 11 and 12). If the two groups of patients are considered together, there seemed to be a correlation between severity of operation and retention of dye, since the last patients of Group II, who probably underwent the least severe type of surgical procedure, also showed the smallest degree of retention postoperatively.

TABLE 1. *Clinical Data.*

Case No.	Age	Sex	Diagnosis	Operation	Duration of Operation	Fall in Blood Pressure	Fluids	Other Disease
	yr.				hr.		cc.	
1	64	M	Squamous-cell carcinoma of gingiva	Local excision of tumor and mandible and radical neck dissection	3	0	500 (glucose) 500 (blood)	—
2	57	M	Squamous-cell carcinoma of tongue	Glossectomy-radical neck dissection	4	0	500 (glucose) 500 (blood)	—
3	38	M	Metastatic squamous-cell carcinoma of neck	Radical neck dissection	3¾	Mild	3000 (glucose) 1000 (blood)	—
4	54	F	Carcinoma of salivary gland	Resection of maxilla and antrum	1¼	0	0	—
5	34	F	Adenocarcinoma of parotid gland	Removal of parotid gland	2½	0	1000 (glucose) 500 (blood)	—
6	54	M	Adenocarcinoma of parotid gland	Removal of parotid gland	¾	0	0	—
7	54	F	Hashimoto struma	Hemithyroidectomy	1	0	500 (glucose)	—
8	60	F	Thyroglossal cyst	Excision of cyst	1	0	0	Epilepsy
9	72	F	Squamous-cell carcinoma of tongue	Partial glossectomy	¾	0	0	—
10	49	M	Previous squamous-cell carcinoma of gingiva; surgical defect.	Plastic upper lip; skin graft.	1	0	0	—
11	44	F	Carcinoma of breast	Radical mastectomy	2¾	0	500 (glucose)	Anemia (hemoglobin of 60%)
12	58	F	Carcinoma of breast	Radical mastectomy	2¼	Mild	500 (glucose)	Hypertensive heart disease, with failure
13	56	F	Carcinoma of breast	Radical mastectomy	2	Mild	500 (glucose)	—
14	60	F	Intraductal papilloma of breast	Local excision	¾	0	0	Hypertensive heart disease, with failure
15	38	F	Periductal mastitis	Local excision	¾	0	0	—
16	32	F	Fibroadenoma of breast	Local excision	½	0	0	—
17	32	F	Unilateral mastitis	Local excision	½	0	0	—
18	48	F	Duct papilloma of breast	Local excision	½	0	0	—
19	47	F	Fibroadenoma of breast	Local excision	½	0	0	—
20	30	F	Sclerosing adenosis of breast	Local excision	½	0	0	—

Discussion

The data show that in 14 of the 20 patients there was a significant increase in the retention of bromsulfalein postoperatively as compared to the amount retained before the operation. The retention of dye was very pronounced in several cases. Whereas all patients, with the possible exception of 1 (Case 7), initially had a normal clearance, the increased retention following the operation in 14 cases resulted in postoperative values that were considered abnormal and indicative of liver dysfunction.

It is obvious that the criteria by which the severity of the operations was evaluated are not absolute, and other factors than the ones considered above may have played a role.

The mechanism by which a surgical operation produces such marked changes in bromsulfalein retention is not entirely clear. Liver dysfunction is a conspicuous and early sign of shock.[8] The early stages of shock may not be manifested by a fall of blood pressure at a time when anoxemia of internal

organs such as the liver and the kidney has already taken place.[9] It is therefore conceivable that although the patients in this series either did not experience a fall in blood pressure or at most showed a slight and transitory fall, they had a certain degree of anoxemia of the liver during the operation, explaining the reduced ability of this organ to clear the blood of dye. In that case, the increased retention of bromsulfalein following an operation might be significant as a measure of the amount of injury inflicted on internal organs by a surgical procedure

If the changes in bromsulfalein retention observed denoted liver dysfunction, the abnormality appeared to be reversible and did not persist longer than a few days. Normal or nearly normal values were observed in almost all patients a few days after the operation.

So far as the thymol turbidity and cephalin flocculation were concerned, it was not expected that the tests would show any significant change. These procedures depend entirely on the presence of an abnormal globulin constituent in blood plasma, and

TABLE 1 (*Continued*).

Case No.	Bromsulfalein Retention				Thymol Turbidity				Cephalin Flocculation			
	Pre-operative	Immediately post-operative	Post-operative*	Post-operative*	Pre-operative	Immediately post-operative	Post-operative	Post-operative	Pre-operative	Immediately post-operative	Post-operative	Post-operative
	%	%	%	%								
1	10	40	18 (5)	—	2.0	1.5	0.5	—	++++	+++	++	—
2	4	36	8 (5)	—	1.05	1.25	1.0	—	+	+++	+	—
3	4	40	6 (4)	—	0.7	0.6	0.5	—	0	++	0	—
4	10	22	14 (10)	—	0.5	0.5	0.7	—	++	0	+	—
5	6	32	8 (4)	—	1.7	1.5	1.1	—	++++	++	0	—
6	6	16	18 (1)	12 (3)	0.8	1.0	1.0	0.8	0	+++	++++	+++
7	12	32	32 (1)	14 (4)	1.3	2.1	2.0	1.1	0	+++	+	—
8	0	64	32 (3)	—	0.9	1.2	1.10	—	+++	+	0	—
9	6	14	4 (14)	—	0.7	0.6	0.5	—	0	++	0	—
10	4	6	2 (4)	—	1.1	1.0	1.1	—	++++	+++	++	—
11	10	24	—	—	2.4	0.8	—	—	0	0	—	—
12	6	40	16 (3)	—	1.0	1.3	1.4	—	0	0	0	—
13	4	4	4 (4)	—	0.9	0.9	0.8	—	0	0	++	—
14	6	12	8 (6)	—	2.2	1.2	1.3	—	0	0	0	—
15	8	16	8 (7)	—	0.7	0.6	0.3	—	0	0	0	—
16	6	16	6 (7)	—	1.3	1.0	0.3	—	0	0	0	—
17	4	6	6 (9)	—	1.1	1.3	1.5	—	0	0	0	—
18	8	10	6 (8)	—	0.2	0.4	0.6	—	0	0	0	—
19	4	4	6 (8)	—	1.6	1.6	1.3	—	+	++	+++	—
20	4	6	4 (6)	—	2.1	1.5	1.6	—	0	0	0	—

*Numbers in parentheses refer to days after operation.

applied to a distant anatomic region. A direct mechanical trauma to the liver during the operation, as in the course of an intra-abdominal operation, seems to be ruled out in the patients of this series by the type of subjects selected.

The anesthesia may have been a contributory factor, although pentothal and ether are not considered to be liver poisons. Nevertheless, this factor cannot be entirely ruled out. The extent of the surgical procedure and its duration, regardless of the type of anesthesia, appeared to be more important. The data do not indicate that the age of the patients was a decisive factor in the production of postoperative liver dysfunction as shown by the retention of bromsulfalein in the blood.

this could hardly be expected to occur during the relatively short duration of the operation. The absence of definite changes in the two tests during the postoperative period indicates that the liver dysfunction detected by the bromsulfalein test in the series of patients studied was not pronounced, and confirms its transitory nature.

These results largely confirm those obtained by previous workers and indicate definite impairment of liver function after protracted surgical operations, even when the operative site is such that mechanical trauma to the liver is ruled out.

The changes in liver function are probably significant in that they may represent one of the factors contributing to the complex syndrome called "post-

operative disease." The prevention and control of these changes deserve further study.

Summary

There was a significant increase in the retention of bromsulfalein immediately after an extra-abdominal operation in 14 of 20 patients studied. No similar changes were observed in the thymol-turbidity and cephalin-flocculation tests.

There was a certain degree of correlation between the severity of the operation and the postoperative appearance of an impaired ability of the liver to clear the blood of bromsulfalein. Other factors, such as anesthesia by ether or pentothal sodium and the age of the patients, appeared less important. The significance of these facts in relation to the physiologic changes brought about by a surgical operation is discussed.

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THE PROBLEM OF SULFONAMIDE-RESISTANT HEMOLYTIC STREPTOCOCCI*

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PREVIOUS reports have discussed the problem and circumstances of the development of sulfadiazine-resistant hemolytic streptococci in the armed forces of the United States during 1944.[1–8] In a civilian community the occurrence of infections due to sulfonamide-resistant hemolytic streptococci[9] indicates that these organisms have had a wide distribution throughout the general population via military personnel. The possibility that these resistant organisms might become an epidemiologic and therapeutic problem in civilian life cannot be dismissed on the basis of the available information. Also, the likelihood of such a situation arising in the general population — that is, the development of sulfonamide-resistant or penicillin-resistant strains of hemolytic streptococci under the common therapeutic and prophylactic regimens — should be considered, and efforts directed toward its prevention.

A study of the sulfonamide sensitivity of hemolytic streptococci in the general population would indicate the prevalence of known sulfonamide-resistant strains and also whether there are naturally resistant strains that might assume increased resistance under proper circumstances. It is the purpose of this paper to present the results of sulfonamide-sensitivity determinations of hemolytic streptococci as they occurred in a New England population, as well as an analysis of the available information pertaining to the conditions under which sulfonamide-resistant hemolytic streptococci developed.

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Methods

The cultures studied were obtained from patients admitted to the Evans Memorial and Haynes Memorial Hospitals, serving Boston and the suburban areas surrounding it, during the fall and winter of 1946–1947. These patients were admitted to the hospital because they had clinical evidence of a streptococcal infection or were admitted for observation or study and found to harbor hemolytic streptococci. Most of the strains of hemolytic streptococci were isolated from the nasopharynx of patients who had clinical scarlet fever; others were obtained from streptococcal carriers or patients with pharyngitis, otitis media, pneumonia or wound infections due to the hemolytic streptococcus.

Cultures were obtained by swabbing of the nasopharynx or infected areas with culture swabs. The swabs were wiped on 2 per cent blood-agar plates, streaked and incubated aerobically at 37°C. for twenty-four hours. Single colonies of beta-hemolytic streptococci were picked and transferred to blood-agar plates or to broth for further identification and study. The hemolytic streptococci isolated were grouped and typed by the precipitin technic[10]; antiserums for Types 1 to 47 were available. The

sulfonamide sensitivity was determined by the method of Wilson,[11] horse serum being used; susceptible and resistant strains were always run as controls. Only organisms growing in a concentration of 5 mg. per 100 cc. of sodium sulfadiazine were considered to be resistant. Occasionally scant growth appeared in the tube containing a concentration of 1 mg. per 100 cc.; however, owing to the conditions of this test, growth in this tube was not considered evidence of resistance.[11, 12]

Results

One hundred and sixty-seven Group A hemolytic-streptococcus strains isolated during the fall and winter of 1946–1947 were tested for sensitivity to the action of sulfadiazine. The type distribution and sulfonamide sensitivity are indicated in Table 1. Types 18, 30 and 31 were the most prevalent; however, there was no predominant epidemic-type strain prevalent in this area. Types 1, 17 and 19, which were the predominant types in the Navy,[1, 2] did not assume any epidemic prominence in this study.

Of 167 strains of Group A hemolytic streptococci tested for sensitivity to the action of sulfadiazine, 166 were sensitive to its action — that is, none grew in a concentration of sodium sulfadiazine as great as 5 mg. per 100 cc. One strain, a Group A, Type 19 hemolytic streptococcus, was resistant to the action of sodium sulfadiazine in a concentration of 25 mg. per 100 cc. This sulfonamide-resistant strain was isolated from a patient who had clinical scarlet fever and later developed electrocardiographic and clinical evidence of rheumatic heart disease. This strain was sensitive to 0.0078 units of penicillin, as determined by the method of Rammelkamp.[13]

Table 1. *Type Distribution and Sulfadiazine Resistance of Group A Hemolytic Streptococci.*

Serologic Type	No. of Strains	No. of Sulfadiazine-Resistant Strains
3	1	0
5	1	0
6	3	0
12	1	0
17	4	0
18	6	0
19	3	1*
23	1	0
24	1	0
26	4	0
28	5	0
30	6	0
31	6	0
36	1	0
38	1	0
39	3	0
42	1	0
43	1	0
47	1	0
†	117	0

*This strain was resistant to the action of sodium sulfadiazine in a concentration of 25 mg. per 100 cc.

†Strains not classified by the precipitin method with available diagnostic serums.

Discussion

Recent publications have offered some suggestions regarding the possible origin of sulfonamide-resistant streptococci.[3, 4, 9, 12, 14, 15] From theoretical points of view these resistant bacteria could exist as naturally occurring variants; they could arise as variants of normally susceptible strains as a result of contact with and adaptation to the drug, or they could arise as spontaneous genetic mutants. Whatever the explanation of this phenomenon, once sulfonamide-resistant variants appear they increase in prevalence in a sulfonamide-containing environment as a result of their greater fitness to survive. It is of interest to determine what light recent clinical and epidemiologic experience has shed on this problem.

Although methods to detect the development of sulfonamide resistance by other bacteria in vitro were known, attempts to demonstrate the resistance of hemolytic streptococci to sulfonamides, by the use of ordinary mediums containing sulfonamide inhibitors, were uniformly unsuccessful.[3] The need for a method of demonstrating sulfonamide resistance in vitro became urgent with the failure of the mass chemoprophylaxis program in the armed forces in 1944. During that year Wilson[11] developed a technic that enabled one to determine the ability of hemolytic streptococci to grow in a semisolid medium free of sulfonamide inhibitor and containing respectively 0, 1, 5, 25 and 125 mg. per 100 cc. of sodium sulfadiazine. This test conclusively demonstrated the presence of sulfonamide-resistant strains of hemolytic streptococci, which were the cause of increasing numbers of upper respiratory infections while sulfonamide prophylaxis was being carried out in the armed forces.[3, 4]

After the first demonstration of sulfonamide-resistant Types 3, 17 and 19 Group A hemolytic streptococci during a program of mass chemoprophylaxis in the armed forces,[3, 4] it became essential to know if there were any resistant strains before this program was inaugurated in the Navy in December, 1943.[1, 2] This information could be obtained only by tests of cultures that had been preserved prior to this program of mass chemoprophylaxis. No sulfonamide resistance was demonstrated in over 100 of the strains of hemolytic streptococci preserved at the Rockefeller Institute Hospital prior to 1937.[16] Siegel[17] showed that 90 strains of Group A hemolytic streptococci isolated from scarlet-fever patients before 1938 were sensitive to the action of sulfadiazine. Sensitivity determinations on strains of hemolytic streptococci isolated from patients with scarlet fever[12] in the United States Navy prior to December, 1943, did not show any evidence of resistance. Most of these strains were Type 19, and some were isolated from patients who had been receiving small doses of sulfadiazine during a scarlet-fever epidemic in New York City.[18] It should be noted that strains of Type 19 later

appearing in the armed forces were resistant to sulfonamides. From this information it seems safe to conclude that before the program of mass sulfadiazine prophylaxis had been initiated in the armed forces in 1943 there were no known sulfonamide-resistant Group A hemolytic streptococci.

Rantz et al.,[14] however, reported the results of testing strains of Group A hemolytic streptococci isolated in the Army from December, 1943, to April, 1944, and observed that some of the typed strains were more resistant than others — that is, that they grew in suspensions of 1 mg. and 5 mg. of sodium sulfadiazine per 100 cc. The authors were of the opinion that these strains were naturally resistant to moderate amounts of sulfadiazine and were the precursors of the more highly resistant strains such as Types 3 and 17, which later became established as epidemic, resistant strains. The possibility of transfer of these resistant strains to Army personnel by members of the Navy on chemoprophylaxis cannot be ruled out.

Several studies of streptococcal carriers treated with sulfadiazine to rid them of the carrier state are enlightening in demonstrating the possibility of the development of resistance under those conditions of treatment. Strains of hemolytic streptococci isolated from 40 patients before and after treatment with therapeutic doses of sulfadiazine did not show any evidence of the development of resistance to sulfadiazine.[12] Another study of 10 carriers treated with 1 gm. of sulfadiazine daily for a ten-week period did not reveal any increase in sulfadiazine resistance of the post-treatment cultures as compared with the pretreatment strains.[17] Hamburger et al.[19] treated 45 carriers of Group A hemolytic streptococci with 1 gm. of sulfadiazine daily for four-day to fifty-day periods, with no development of sulfadiazine-resistant strains during the treatment period. So far as is known at present, no evidence of the development of resistant strains of hemolytic streptococci has been reported from any rheumatic fever patients who are receiving daily prophylactic treatment with sulfonamides.[20] Under the conditions of the studies cited above, no resistant strains of hemolytic streptococci developed.

The spread and epidemiologic problems that these resistant organisms presented in the armed forces have been summarized in previous reports.[3–8, 15] Although it was known that the civilian population was exposed to these resistant strains of hemolytic streptococci, no epidemics therefrom were reported until 1946, when an outbreak of Type 19 infections appeared in Cooperstown, New York.[9] Except for the Type 19 strains, resistant to 25 mg. per 100 cc. of sodium sulfadiazine, isolated during that study, none of the types showed any evidence of resistance. In the present report all strains, except the one resistant Type 19 strain, were susceptible to the action of sodium sulfadiazine. Apparently, there have been no problems of therapy in these resistant streptococcal infections since they can be adequately treated with penicillin.[21]

The results of the present study of 167 strains of Group A hemolytic streptococci indicate that only one strain, which belonged to Type 19, was resistant to the action of sulfadiazine. This strain grew in a concentration of 25 mg. of sodium sulfadiazine per 100 cc. — the same concentration as the epidemic Type 19 strains that were prevalent in the armed forces. The source of this strain is not known, but it was probably introduced into this area by Army or Navy personnel. The possibility that this resistant strain is a naturally resistant variant cannot be ruled out, but the available information indicates that the resistant organism encountered in this study was the same as that in the armed forces.

The data of this study show that sulfonamide-resistant variants of Group A hemolytic streptococci did not arise in this area of Boston and its environs, where sulfonamides are used in the customary manner in the treatment of patients and where sulfonamide prophylaxis has not been widely employed.

From the accumulated evidence presented, it seems that conditions of mass sulfadiazine prophylaxis as they existed in the armed forces[1, 2] were conducive to the development of sulfadiazine-resistant strains of hemolytic streptococci. Regarding the conditions under which drug-resistant organisms can be expected to arise, one observer has postulated that "the infection shall be a common type providing very large numbers of micro-organisms within which a rare mutation has a chance to arise, and second — and this is the medically important point — that a large proportion of the potential hosts shall be treated with the drug in question."[16] To date these resistant strains have not presented any particular problem in civilian life and can be adequately treated by penicillin therapy. The possibility of the development of resistant strains of bacteria during large-scale mass prophylactic programs should be kept in mind, and such programs should be used only as an emergency measure.

Summary

Sulfonamide sensitivity determinations on 167 strains of Group A hemolytic streptococci, isolated from patients from Boston and surrounding suburbs, are presented. Only one strain, Type 19, was resistant to 25 mg. per 100 cc. of sodium sulfadiazine.

The pertinent literature regarding the development of sulfonamide-resistant hemolytic streptococci is reviewed.

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MEDICAL PROGRESS

THE ROLE OF PLEUROPNEUMONIA-LIKE ORGANISMS IN GENITOURINARY AND JOINT DISEASES (Concluded)*

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THE high incidence of acute joint disease in male patients with positive prostatic cultures, in addition to the knowledge that animals infected with L organisms frequently have arthritis, suggests that pleuropneumonia-like organisms play a role in producing the joint disease in the patients. The hypothesis that this organism is the cause of the arthritis is somewhat supported by the fact that in 2 cases of Reiter's syndrome (as Case 11) L organisms were cultured from the knee-joint fluid. However, no L organisms were found in the synovial fluids in the other 11 cases in this series in which a search for these organisms was made.

In women, a relation between the presence of the L organism in the genital tract and the development of joint disease was not so apparent. Among 58 women yielding positive cultures in the original series, only 9 had joint complaints. One of these patients also had gonococci in the cervical cultures. Two other cases were arbitrarily introduced into the series since they had rheumatoid arthritis and formed part of a group of 12 female patients with rheumatoid arthritis in whom routine examination of cervical cultures for L organisms was made. Five of the 6 remaining patients had had swelling and pain of long duration in various joints. The other patient (Case 10) had an acute arthritis that had developed two weeks after marriage. Her husband (Case 9) also developed joint symptoms eight weeks after marriage, and L organisms were found in the prostate at that time. In view of the high incidence of L organisms in the female genital tract (26 per cent) and the relatively low percentage of joint disease in female patients with positive cultures, there is no definite evidence of a relation between the L organism and the joint disease in these cases. However, the observations in the married couple suggest not only that the joint involvement was related to the L organism but also that certain strains have a greater tendency than others to produce joint disease. Further suggestion of a possible relation between the L organism and joint disease in women was furnished by 2 other patients, seen since the original series was completed, who had acute arthritis at the time cervical cultures were positive for L organisms and negative for gonococci.

Until further information is available concerning the pathogenicity of the various human strains of pleuropneumonia-like organisms, it is difficult to conclude whether or not the conditions produced by these organisms are contagious. Certain findings suggest that they are. The wives of 5 of the men from whose prostates L organisms were cultured

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were studied, and in 2 cases L organisms were found in the cervical cultures. In 1 case — that of the married couple discussed above — both husband and wife developed acute arthritis soon after marriage. Beveridge, Campbell and Lind[9] cultured pleuropneumonia-like organisms from 3 of 11 women from whom men had contracted nonspecific urethritis. The fact that the genitourinary, joint or eye symptoms in at least 7 of the men with positive cultures in the present series developed within a few days after sexual exposure suggests that the disease is venereal in some cases. However, in many cases no history of exposure was obtained. The possibility that the gastrointestinal tract was the portal of entry in some cases is suggested by the fact that at least 6 patients had diarrhea just before or at the onset of the disease.

The treatment of diseases produced by pleuropneumonia-like organisms is still in an experimental stage. In rats and mice these diseases have been shown to be prevented or effectively treated in a high percentage of cases by gold compounds[22, 23] and by streptomycin.[24] Penicillin has not been effective in animals.[25] Pleuropneumonia-like organisms are not sensitive in vitro to sulfonamides or penicillin, but the growth of some strains has been found to be inhibited by streptomycin in a concentration of 20 microgm. per cubic centimeter.[17] In the present series gold was used in only 1 patient (Case 4) and was ineffective. None of the patients treated with sulfonamides or penicillin showed any improvement in the genitourinary or joint symptoms. Streptomycin was used in 8 patients in whom the infection was limited to the genitourinary tract (see Cases 4 and 5), including 4 cases of cystitis, in 1 patient with acute arthritis associated with urethritis, and in 5 patients with Reiter's syndrome (Case 12).* In 7 of the 8 cases of genitourinary-tract infection there was rapid disappearance of symptoms during treatment, and cultures became negative for L organisms. The eighth case, in a patient who had had urethritis for sixteen years (Case 4), showed only a transient improvement in symptoms, and the pleuropneumonia-like organisms did not disappear from the urethral cultures. In the patients with acute arthritis or Reiter's syndrome, there was improvement in symptoms during and immediately after treatment. However, evidence of joint inflammation persisted for weeks, and the sedimentation rates remained elevated. In none of the cases were L organisms cultured after treatment. Streptomycin therapy did not prevent recurrences of the disease in Case 12. The results of streptomycin therapy were not conclusive but indicate that the drug is probably effective in most cases of uncomplicated genitourinary-tract disease due to pleuropneumonia-like organisms. In Reiter's syndrome the results were sufficiently suggestive to warrant further trial of this therapy.

*We are indebted to the Committee on Chemotherapeutics of the National Research Council for the streptomycin used during most of this study and to Merck and Company for the streptomycin now being employed for test of its efficacy in the treatment of infections due to pleuropneumonia-like organisms.

Case Reports

The following brief abstracts include characteristic cases from the various groups.

Case 1 (M. G. H. 22349).† A 33-year-old female research worker who handled rats almost daily and who gave no history of previous genitourinary disease noted sudden onset of tenderness and swelling of the right labium majus 10 days after marriage. On examination an abscess of Bartholin's gland was found. Cervical smears were negative for gonococci. Excision of the abscess *in toto* was performed, and cultures were made at the operating table from the center of the abscess, which contained creamy-yellow pus. These cultures yielded an abundant growth of L organisms in pure culture. Streptobacilli or gonococci could not be demonstrated by smear or culture. The patient recovered uneventfully.

Case 2. An 18-year-old single girl noted the onset of profuse vaginal discharge 4 days after intercourse. On examination there was an acute vaginitis, with a fiery-red mucosa and yellow purulent exudate. Cultures of this exudate yielded a pure growth of L organisms. Gonococci could not be demonstrated by smear or culture. The vaginitis cleared up within 1 week.

Patients with Urethritis and Prostatitis

Case 3. A young married man, 36 hours after extramarital exposure, observed slight urethral discharge. On examination no discharge was apparent, but the prostate was found to be swollen and painful. In the culture made from a sample of urine immediately after prostatic massage many L colonies but no gonococci were seen. A second culture 10 days later was negative for L organisms and for gonococci. The subsequent clinical course is not known.‡

Case 4 (M. G. H. 492207). A 35-year-old married man was admitted to the hospital because of persistent urethral discharge. Sixteen years previously, 3 days after intercourse, he had developed a yellowish urethral discharge and inguinal lymphadenopathy. The discharge had not changed throughout the 16 years despite many types of treatment, including sulfonamides, penicillin and numerous kinds of local therapy. Cultures had always been negative for gonococci, but during the year before admission had been positive for pleuropneumonia-like organisms on several occasions. Examination was negative except for slight urethral discharge and enlargement of the prostate. The patient was treated with streptomycin, in a dosage of 4 gm. a day, for 1 week. The discharge disappeared after 1 day of treatment, but cultures of the prostatic secretion continued to show many colonies of L organisms. Ten days after treatment was stopped the discharge returned and has persisted for the past 11 months. During this interval he has been treated with myocrisine, receiving 325 mg. in 5 weeks without effect.

Patients with Cystitis

Case 5 (M. G. H. 532255).§ A 26-year-old single man was admitted to the hospital because of frequency of urination and terminal hematuria. Three years before admission he had had urethral discharge and frequency of urination lasting for several weeks. Subsequently, there had been repeated recurrences of burning and frequency. Two weeks before admission he had first noted blood in the terminal portion of the urine. Cultures had always been negative for gonococci. Examination was negative except for the fact that the prostate was rather soft. The urine was loaded

†We are indebted to Dr. L. Parsons, of the Massachusetts General Hospital for permission to report this case. Reference to this patient has been made by Dienes and Edsall.[3]

‡This was a patient of the late Dr. Richard F. O'Neil.

§We are indebted to Dr. Fletcher H. Colby, of the Massachusetts General Hospital, for permission to include this case, which has also been reported by Kane and Foley.[26]

with erythrocytes and leukocytes. Three routine cultures of urine showed no growth, but cultures on boiled blood ascitic agar contained numerous colonies of pleuropneumonia-like organisms. The patient was given 2 gm. of streptomycin daily for 4 days and 1 gm. daily for the following 5 days. Cultures became negative for L organisms after 3 days of treatment, and the urinary sediment showed only rare cells. There has been no recurrence of symptoms in the subsequent 14 months.

Patients with Chronic Arthritis

Case 6 (M. G. H. 534532). A 32-year-old married man was admitted to the hospital because of severe pain and redness of the right eye of 1 week's duration. Seven years before admission he had had a urethral discharge, smears from which were reported to contain gonococci. Five years later he had begun to notice migratory pains in the hips, right knee, neck and lower back. Six months before admission the right knee became swollen and painful. Examination showed an iritis of the right eye with marked ciliary injection, an effusion in the right knee and slight tenderness and induration of the prostate. Prostatic cultures showed a moderate growth of L organisms and of nonhemolytic streptococci. The arthritis subsided in 3 months, but the iritis still persists at the end of 11 months. During this period central choroiditis has developed and has been treated with fever induced by intravenous injection of typhoid vaccine. Prostatic cultures have remained positive for L organisms.

It is impossible to determine whether or not the various features of this patient's disease are interrelated in any way.

Patients with Acute Arthritis without Eye Involvement

Case 7 (M. G. H. 352561). A 47-year-old married man noted burning on urination 2 or 3 days after sexual exposure. One week later he developed stiffness of the knees, right wrist and right shoulder. The stiffness of the knees persisted, and 3 weeks later the left wrist became very swollen, red, hot and tender. These symptoms subsided in 2 or 3 days, but the right wrist became involved. Examination on the following day showed tenderness, increased heat and pitting edema of the right wrist and the dorsum of the right hand and a moderate-sized effusion in the left knee, which was warm and tender. The prostate was tender and boggy. Culture of the prostatic secretion showed numerous colonies of L organisms and *Staphylococcus aureus*, but was negative for gonococci. All symptoms subsided in 2 weeks though the sedimentation rate remained elevated. There was no recurrence of symptoms during the subsequent 2 years.

Case 8 (M. G. H. 315068). A 29-year-old single man had had a urethral discharge 6 months before admission. Soon thereafter he had noted pain and swelling of the left knee, left third toe and right third finger. There had been no response to sulfonamide therapy, but the symptoms subsided slowly over the course of 4 months. Two weeks before admission the urethral discharge recurred, and pain developed in the right hip, left shoulder and tarsometatarsal joints on both sides. The patient had had a urethritis, said to be of gonococcal origin, 8 years before admission. On examination at the time of admission the left knee contained a moderate-sized effusion and was tender. The prostate was large and boggy. Cultures of prostatic secretion showed abundant L colonies but no gonococci. The patient was again treated with sulfonamides with no effect. The symptoms gradually disappeared over the course of 2 months. Cultures of prostatic secretion were negative for L organisms 4 years later.

Case 9 (M. G. H. 291517). This 38-year-old man, the husband of the patient in Case 10, was seen in 1942, when he had been married 8 weeks. He had had urethritis in 1929 and again in 1934. Gonococci were said to have been seen in smears during both these attacks, but they could never be demonstrated at any time thereafter. In 1937, 1940 and 1941 he had been treated for chronic prostatitis, smears showing pus cells but no gonococci. In March, 1942, the patient was admitted to the hospital for painful swelling of the left wrist of 3 days' duration. On examination the prostate did not feel abnormal, but massage yielded fluid containing 20 to 30 pus cells per high-power field. Cultures yielded no gonococci but gave an abundant growth of L organisms, streptococci and diphtheroids. Four months later pain and swelling developed in the right elbow, persisting for 9 months. During this episode the prostate was found to be boggy, and the vesicles were tender. Prostatic cultures yielded occasional L organisms and an abundant growth of bacteroides, nonhemolytic streptococci and *Staph. albus*. Four years later the patient had recurrent attacks of pain in the left flank, and x-ray study showed a stone in the lower end of the left ureter. At the time of admission for removal of the stone, the urine was cultured but showed no growth of pleuropneumonia-like or other organisms.

Case 10 (M. G. H. 348216). A 30-year-old woman, the wife of the patient in Case 9, was admitted to the hospital in March, 1942, 3 days after her husband's first admission. She gave no history of genitourinary disease and had been well until 6 weeks before entry, when, 2 weeks after marriage, she developed stiff, swollen knees. There was no redness or heat about the knees, and the swelling caused only moderate discomfort. No other joints were involved, and there was no fever and no constitutional symptoms. Pelvic examination revealed a slight cervical discharge, cultures of which yielded a pure growth of L organisms. No organisms were found in gram-stained or Giemsa-stained films of the joint fluid, and none could be recovered in culture. The patient was discharged unimproved after 1 week. The involvement of the knees gradually subsided during the following year.

Patients with Acute Arthritis with Eye Involvement (Reiter's Syndrome)

Case 11 (M. G. H. 440804).* A 26-year-old single man developed a purulent urethral discharge 36 hours after sexual exposure. He was treated with sulfathiazole and sulfadiazine, but the discharge persisted and 3 weeks after onset he noted burning, frequency, urgency and terminal hematuria. Approximately 5 weeks later bilateral conjunctivitis appeared, and within a few days he complained of pain in the lumbosacral region, as well as pain and swelling of the right ankle, right shoulder, left elbow and left knee. On examination 3 days later, the temperature was 100.4°F., with slight conjunctival injection and swelling and tenderness of the right ankle, left knee and right sternoclavicular joint. The urethral discharge had subsided, but a catheterized specimen of urine was loaded with white cells. Cultures of the urine and prostatic secretion showed an abundant growth of L organisms and a few colonies of staphylococci but were negative for gonococci. Two colonies of L organisms were found in the culture of fluid from the left knee. At the time of discharge, cultures of the urine showed only a few L organisms. The patient was treated with 120,000 units of penicillin without effect, but all symptoms subsided slowly during the course of 2 months.

Case 12 (M. G. H. 255127). A 26-year-old single man had had pain in the right ankle and right knee and slight urethral discharge for 2½ weeks before admission. Examination revealed marked swelling of the right knee, with an effusion and moderate swelling of the right ankle. The prostate was slightly enlarged and boggy. Three weeks later an iritis developed in the left eye. Culture of the prostatic secretion showed abundant growth of L organisms and many streptococci and colon bacilli but was negative for gonococci. The patient was treated with sulfathiazole and penicillin without effect. The symptoms gradually subsided during the course of 6 months. He had had a similar attack 4 years previously, with bilateral conjunctivitis and keratitis, purulent urethral discharge and arthritis. There had been a second attack 1 year later, manifested by urethral discharge, balanitis and prostatitis, bilateral conjunctivitis and keratitis and arthritis.†

After the third attack described above had subsided, the patient remained entirely well except for occasional episodes of slight conjunctivitis until 1 year after discharge, when prostatic massage was performed. Culture of the prostatic

*We are indebted to Dr. Fletcher H. Colby, of the Massachusetts General Hospital, for permission to report this case, the genitourinary features of which have been reported by him.[37]

†These first two attacks have been reported elsewhere.[38]

secretion was negative for L organisms. Two days later, he noted slight urethral discharge and 1 week later developed bilateral conjunctivitis. During the following week, the right hip and both knees became painful. On examination the conjunctivas of both eyes were markedly inflamed. The right hip was painful, and both knees contained effusions. Prostatic cultures showed an abundant growth of L organisms and a few staphylococci but no gonococci. The urethritis and conjunctivitis subsided in 2 weeks, but during the following 2 months, he continued to have intermittent attacks of pain, swelling and tenderness of wrists, knees and left first metacarpophalangeal joint. Roentgenograms showed moderate decalcification of the bones around the knees and wrists. At the end of 2 months, streptomycin was obtained, and the patient received 21.5 gm. in 6 days. Subsequently, he had no further recurrence of joint symptoms though the sedimentation rate remained slightly elevated for 3 months.

Thereafter, he continued to feel well until 3 months later, when he noted stiffness and swelling of the left knee. Four days later there was recurrence of slight urethral discharge and on the following day slight conjunctivitis. On examination 5 days later, the left knee and the interphalangeal joint of the right first toe were hot, red, very painful and swollen. There was a severe conjunctivitis, with purulent discharge, and a slight urethral discharge. Cultures of the urethral discharge and of the urine showed a moderate growth of L organisms and a few colon bacilli and *Staph. albus* and *Staph. aureus*. Roentgenograms showed persistence of slight decalcification of the bones around the knees. The patient was treated with streptomycin in a dosage of 4 gm. a day for 13 days. The urethritis and conjunctivitis subsided within 1 week, but swelling of the left knee persisted for 2 months. The sedimentation rate has remained slightly elevated for the past 5 months.

Discussion

The observation that human beings may harbor organisms belonging to a group that includes several important animal pathogens is in itself interesting. Interest is heightened by the fact that these pleuropneumonia-like organisms appear to be pathogenic to human beings. The most definite indication of pathogenicity has been obtained from the study of male patients. The fact that all the patients in this series had urethritis, prostatitis or cystitis suggests that the organism is pathogenic for the genitourinary tract. Most impressive were the patients with cystitis, such as Case 11, in whom the L organisms were present in pure culture for a long period and decreased markedly or disappeared from the urine as the clinical symptoms subsided. Further indication of the pathogenicity was obtained from one of the patients with Reiter's syndrome (Case 12). L organisms were cultured from the prostatic secretion at the onset of three separate attacks of the disease and were not found in the interval between the episodes.

The presence of acute joint involvement in 27 of the 58 men with positive cultures for L organisms suggests pathogenicity for synovial tissues as well as the genitourinary tract. In 2 patients with Reiter's syndrome, organisms were cultured from the synovial fluid. This association with joint disease is of particular interest because joint involvement is a common feature of the diseases produced by the pleuropneumonia group of organisms in animals.

The evidence of pathogenicity gained from the study of female patients is more equivocal. The relatively high incidence of L organisms in the female genitourinary tract suggests that they are part of the normal bacterial flora in this location. On the other hand, their presence in various inflammatory processes of the genitourinary tract either in pure culture or in much greater abundance than other bacteria suggests that they are at times pathogenic.

In evaluation of the evidence gathered to date it should be remembered that some strains are presumably not recovered by the present methods, and that the strains isolated probably belong to more than one species and differ in their pathological significance. The fundamental biologic study of the organism obtained from human beings is still in a primitive stage. The cultural methods, which at present are the only means of recognition, are probably inadequate. Attempts are now being made to develop biologic methods, such as serologic and skin tests. The need for a more detailed study of the properties of the various strains, especially their serologic characteristics and their pathogenicity, is indicated by the observations that attest to their ability to cause disease in human beings.

Further difficulty in evaluating the role of pleuropneumonia-like organisms arises from the fact that some of the bacteria commonly found in human beings grow in an L variant form under certain cultural conditions, as in the presence of penicillin. Because of this difficulty, the 8 male patients with severe urinary-tract infection in whom L organisms were found only after the growth of other bacteria was suppressed either by addition of penicillin to the medium or by treatment of the patient with penicillin or streptomycin have not been included in the present series. It is impossible to assess the significance of the L organisms in these cases. It seems probable that they represent one of the many organisms that together cause the urinary-tract infection. However, they may be variant forms of the other bacteria present in the inflamed urinary tract.

Summary

The properties of pleuropneumonia-like organisms (L organisms) and the methods used for their isolation and identification are briefly described.

Pleuropneumonia-like organisms were present in 58 of 222 routine specimens (26 per cent) from the uterine cervix and vagina and may be part of the normal bacterial flora in these locations. Suggestion of possible pathogenicity, however, was provided by their recovery from inflammatory processes of the female genital tract.

Pleuropneumonia-like organisms were found in only 6 of 71 routine specimens from the male genitourinary tract. Evidence of their pathogenicity was more definite than that in women, since all 58 patients of this series from whom positive cultures were obtained had urethritis, prostatitis or cystitis. In 6 of the 9 cases in which the

infection extended into the bladder the organisms were obtained in pure culture from the urine. Gonococci and L organisms were found simultaneously in only 2 male patients.

Material from other sources, including the respiratory and gastrointestinal tracts and cerebrospinal fluid, was examined by similar methods but with negative results except in synovial fluids from 2 patients with Reiter's syndrome.

Eighteen of the 58 male patients with genito-urinary-tract infections had an acute type of arthritis when the cultures were positive for L organisms. Nine of these men had simultaneous urethritis, conjunctivitis and arthritis, the syndrome characteristic of so-called Reiter's disease. In 1 patient L organisms were found in the prostate during three attacks of the disease.

These observations indicate that pleuropneumonia-like organisms have pathogenic activity in the genitourinary tracts of men and women and may be related etiologically to an acute infectious type of arthritis and to Reiter's syndrome.

We are indebted to the following physicians for permission to include cases in this series: Drs. F. Albright, J. D. Barney, W. W. Beckman, R. Chute, F. H. Colby, L. W. Kane, S. B. Kelley, S. McGinn, L. S. McKittrick, J. V. Meigs, L. Parsons, C. L. Short and H. I. Suby, of the Massachusetts General Hospital; Dr. R. L. Berg, of the United States Naval Hospital, Chelsea; Drs. T. H. Flynn and A. H. Mayby, of the United States Marine Hospital, Brighton; Dr. J. A. McLaughlin, Naval Air Station, Squantum; Dr. T. A. Warthin, Veterans' Administration Hospital, West Roxbury; and Cushing Veterans' Administration Hospital, Framingham.

Eight of the cases of this series have been included in other papers.[2, 26, 27, 29] Seven others will be reported by Berg and McLaughlin.

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CASE RECORDS OF THE MASSACHUSETTS GENERAL HOSPITAL

Weekly Clinicopathological Exercises

FOUNDED BY RICHARD C. CABOT

TRACY B. MALLORY, M.D., *Editor*

BENJAMIN CASTLEMAN, M.D., *Associate Editor*

EDITH E. PARRIS, *Assistant Editor*

CASE 34161

Presentation of Case

A three-and-a-half-month-old male infant entered the hospital because of persistent diarrhea.

The birth weight was 6 pounds, 3 ounces, and a statement was made that the baby was blue at birth. However, he gained weight at a normal rate, ate well, and seemed normal in every way except that when he cried or breathed rapidly some cyanosis appeared. There had never been any convulsions, hematuria, vomiting or jaundice.

Four weeks prior to entry the patient developed a cough and coryza, and had several bouts of what were said to be projectile vomiting. Four days later he was taken to another hospital, where a diagnosis of bronchopneumonia was made. X-ray films at that time showed the heart to be to the right of the sternum and an additional diagnosis of congenital heart disease was made. He remained in the hospital and ten days before admission to this hospital he developed a persistent and moderately severe diarrhea (ten to twelve bowel movements per day). Several of the other infants on this ward also developed diarrhea at about the same time. Five days before admission the diarrhea became much severer, and penicillin therapy was started. Because of the persistent diarrhea the patient was transferred to this hospital.

Physical examination revealed a marasmic and cyanotic infant. He appeared to be fairly well hydrated. Cyanosis was present to a mild degree but was considerably intensified when the patient cried. The chest was clear to percussion and auscultation. The heart was percussed to the right of the sternum and the point of maximum impulse was in the fifth interspace 4 cm. to the right of the sternum. The rhythm was normal, and the rate was 140. There was a soft, Grade II systolic murmur heard best in the third interspace to the left of the sternum.

Examination of the blood disclosed a red-cell count of 4,740,000, with a hemoglobin of 14 gm., and a white-cell count of 7500, with 88 per cent neutrophils. The urine was normal. Blood cultures were negative, and cultures of the stool showed no significant organisms. A blood Hinton test was negative. A tuberculin test in a dilution of 1:1000 was negative.

Soon after admission the number of daily bowel movements decreased markedly, until they became normal. On the third hospital day the child had an episode of severe cyanosis associated with vigorous respiratory activity. The trachea was suctioned, and much thick white mucus was recovered. The patient recovered entirely within fifteen minutes.

The next day a swallow of lipiodol was given, and x-ray examinations showed no evidence of an esophagotracheal communication. The lipiodol passed down the esophagus into the stomach, which lay in normal position on the left side. There was no evidence of constriction of the esophagus. There was a slight indentation opposite the arch of the aorta, which seemed to indicate that the aorta descended on the left side. There was also a questionable filling defect just above the aortic arch as seen on the anteroposterior view. The lung fields were essentially clear, without evidence of active disease. The pulmonary vascular markings throughout seemed to be decreased. The apex of the heart lay in the right midclavicular line (Fig. 1).

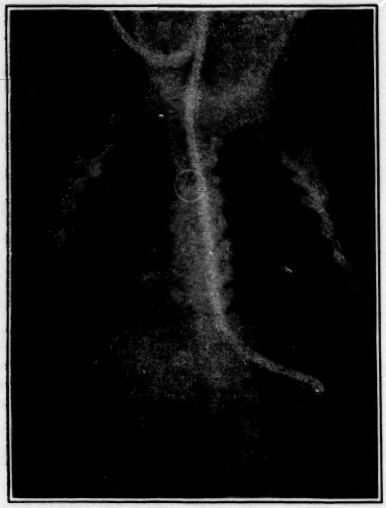

FIGURE 1. *Roentgenogram, Showing the Apex of the Heart in the Right Midclavicular Line.*

On the sixth hospital day the patient had a cyanotic episode, much the same as the previous one. However, suction did not relieve the attack, and a laryngoscope and then a bronchoscope were passed and a small amount of mucus was removed. After oxygen had been administered for some time the patient was able to breathe somewhat more easily, but there was still considerable forcefulness to the respiratory movements and some retraction of the interspaces. Because of the presence of bubbling rales at the lung bases sulfadiazine and penicillin therapy were instituted. An electrocardiogram was interpreted as being consistent with dextrocardia. The spinal fluid was not remarkable. Bilateral subdural taps were done on the eighth day, without return of fluid. On the fourteenth day the temperature began to spike up to 102°F. The white-cell count was 10,900. Physical examination showed a questionable decrease in the percussion note over the left lower lobe. Because he was not taking his feedings very well, the patient had been started on stomach-tube feedings. On the twentieth hospital day, immediately after one feeding, he began to cough, became cyanotic, breathed very rapidly, and died, despite attempts at suction and artificial respiration.

DIFFERENTIAL DIAGNOSIS

DR. FRANCIS MCDONALD: Will Dr. Wyman please demonstrate the films?

DR. STANLEY M. WYMAN: The best demonstration of the esophagus is shown by the opaque tube, which extends through the esophagus into the stomach on the right side. The heart is seen on the right.

DR. MCDONALD: "There was a slight indentation opposite the arch of the aorta, which seemed to indicate that the aorta descended on the left side."

DR. WYMAN: That is suggested on one of the spot films. However, a better look at the plain film with the tube in place shows a considerable shadow to the right of the esophagus and trachea, which makes me think that the aorta actually descends on the right side rather than on the left. I think that the observation of the left-sided aorta is perhaps inaccurate. The filling defect I cannot identify. There is good filling of the esophagus in this portion. I can detect no true abnormality from the films, which are not satisfactory and are noncontributory. The chest films show that the heart is in the right side of the chest, with the apex pointing to the right. The heart is not grossly enlarged. The pulmonary-vascular shadows are decreased in prominence. There is some multiple increased density in the left lung field medially. I should think that this was some sort of pneumonic process. It is seen on the other films consistently. We can therefore say that the heart is not grossly enlarged and lies on the right side (a dextroposed heart), the pulmonary vascular shadows are decreased in prominence and there is presumably some congenital anomaly.

DR. RONALD C. SNIFFEN: The liver is on the right side?

DR. WYMAN: Yes; it is on the correct side.

DR. MCDONALD: Was the mucus removed by the bronchoscope cultured?

DR. CHARLES U. LOWE: It was cultured and yielded *Staphylococcus aureus*.

DR. MCDONALD: I would welcome expert advice on the electrocardiogram.

DR. SNIFFEN: I do not believe there is anyone here who can give it.

DR. MCDONALD: It sounds like a relatively clear-cut interpretation. About the only mistake that might be made is transposition of the arm electrodes.

I am not a cardiac expert, so that for the interest of the group, I shall quote from Taussig's* book:

> Lead I is in the mirror image of normal. Leads II and III replace each other. In Lead I both P waves and the T waves are normally inverted and the principal deflection of the QRS complex is downward. The findings in Lead III are those usually seen in Lead II and the form of deflection in Lead II is similar to that seen normally in Lead III.

DR. SNIFFEN: The interpretation of the electrocardiogram was as follows: "The tracing is consistent with dextrocardia and inverted Lead 1 and interchanged electrodes 2 and 3 give normal axis and T waves."

I might say that the child did much better in an oxygen tent than is indicated in the record.

DR. MCDONALD: It seems as if we have two main categories for diagnosis here. One is infection. We have an infant in an age group that is immunologically immature, subject to invasion by colon bacilli, staphylococci, influenza bacilli and other organisms, in addition to the usual streptococcal and pneumococcal invaders of the respiratory tract. It is extremely important in this age group to obtain blood cultures (using pour plates and broth flasks) and cultures of coughed-up secretions to obtain a precise idea what the organism is and to govern therapy accordingly. This patient was given sulfadiazine and penicillin, probably on that basis. *Staph. aureus* was obtained on one attempt and cannot be passed off as a contaminating organism, as it frequently may in an adult group. Staphylococcus may be an invading agent in this age group. The cough, the dyspnea, the course and the x-ray findings, which might possibly be consistent with an early atelectasis or bronchiectasis as well as pneumonia, make me conclude that the baby did have pneumonia. The second diagnosis is a definitely proved cardiac abnormality. I believe that we can take the word of Dr. Wyman that displacement of the heart was not likely from any of the physical findings or x-ray evidence. The electrocardiogram of dextrocardia is a conclusive finding. The presence of dextrocardia without situs inversus markedly increases the likelihood of associated anomalies. We can therefore assume that, in addition to the dextrocardia, either there were anomalies of the heart itself or, if by chance the aortic arch was on the left side, there was a good likelihood of anomalies of the vessels at the base of the heart. As may be seen in this case, the heart is twisted around, with the aortic arch where it should be normally, with the corresponding difficulty in readjustment of the vessels at the base. In addition to the diagnosis of dextrocardia without situs inversus I shall say question of pulmonary stenosis, question of single ventricle and question of anomaly of vessels at the base of the heart.

DR. SNIFFEN: You took care of this patient, Dr. Lowe. Have you anything to add?

*Taussig, H. B. *Congenital Malformations of the Heart.* 618 pp. New York: Commonwealth Fund, 1947.

DR. LOWE: There are two things that might be clarified — first of all the difficulties with inspiration; the cyanosis usually followed feeding, which strongly suggested vascular anomaly at the base of the heart. The second point is that it was obvious that oxygen helped the child, which is unusual in children with cyanotic heart disease.

DR. RICHARD SCHATZKI: Is it not likely if a baby is short of breath that feeding usually makes the difficulty worse?

DR. LOWE: The child was not short of breath normally. The extreme attacks described in the record occurred seven times while the child was in the hospital, and the last one was fatal. Dyspnea was not part of the general picture.

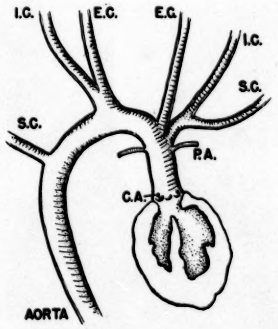

FIGURE 2. *Drawing of the Heart and Great Vessels, Showing Persistent Truncus, Patent Interventricular Septum, Tricuspid Semilunar Valve, Pulmonary Arteries from Truncus, Persistent Fifth Aortic Arch on the Left and Right Sided Aorta.*

CLINICAL DIAGNOSES

Asphyxiation due to aspiration of feeding.
Persistent double aortic arch.
Dextrocardia.
Pneumonia.
Congenital heart disease.

DR. MCDONALD'S DIAGNOSES

Pneumonia.
Dextrocardia:
? Single ventricle.
? Pulmonary stenosis.
? Anomaly of vessels at base of heart.

ANATOMICAL DIAGNOSES

Right-sided aorta.
Persistent truncus arteriosus.
Patent interventricular septum.
Persistent fifth aortic arch on left.
Acute purulent bronchitis with early bronchopneumonia.

Pathological Discussion

Dr. Sniffen: At the time of death the patient was somewhat emaciated and cyanotic. The abnormal findings were confined to the heart and lungs. In the lungs there was a generalized purulent bronchitis most marked in the left lower lobe. This was accompanied by a mild peribronchial inflammatory infiltration involving the alveolar walls and septums. On the left side there was a fibrinous and fibrous pleurisy without effusion. A small amount of mucus and aspirated gastric contents were found in the trachea and major bronchi. The apex of the heart lay in the right midclavicular line. The pericardium and myocardium were normal, the latter measuring 4 mm. in each ventricle. The heart was slightly enlarged.

The dissection of maldeveloped hearts is confusing, since minor structural variations change the interpretation of the developmental abnormalities a great deal. I shall demonstrate several diagrams so that I will not become snarled in the mechanics of the arterial abnormalities.

The first is a drawing of the heart and great vessels in this child (Fig. 2). The heart showed a persistent truncus, and as might have been expected with this anomaly, there was a defect in the membranous septum between the ventricles. The truncus overlay both ventricular chambers, but mainly the right ventricle. The outlet was guarded by three normal semilunar valve cusps of equal size. The coronary vessels followed the usual course. There was a right-sided aorta. The first branches to arise from the truncus were two minute pulmonary arteries, which were not over 1 mm. in diameter. The ductus arteriosus was not patent. Then, as one proceeded distally along the arch of the aorta, just beyond the left pulmonary vessel, an arterial trunk left the aorta. This trunk divided immediately into two branches, the first giving rise to the left subclavian and internal carotid arteries, and the second to the left external carotid artery. The next aortic branch was the right common carotid artery, with its external and internal divisions, and the last major vessel to leave the aortic arch was the right subclavian artery.

We believe that these structural abnormalities were the results of the disintegration of the first four aortic arches on the left side, with persistence of the fifth aortic arch (Fig. 3). The reason for this opinion is the fact that the main trunk on the left side was very short. If it were long, we could be confident that the fourth arch had persisted after the disintegration of the first three arches. Furthermore, this main trunk arose immediately distal to the left pulmonary artery. On the right side the fourth arch and dorsal aorta had persisted to form the main arterial trunk.

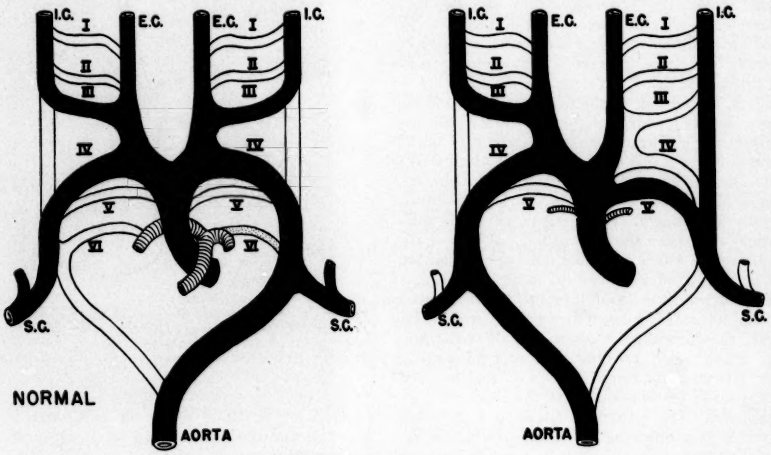

Figure 3. *Drawing, Showing Disintegration of the First Four Aortic Arches on the Left, with Persistence of the Fifth Aortic Arch.*

The formation of three equal semilunar cusps in the truncus is difficult to understand. One would expect four cusps of equal size or unequal size or three unequal cusps. In fact the truncus had the structure of a normal aorta.

As a sidelight, the left lung was divided into three lobes, and the right lung had only two lobes.

No constrictions were found in the esophagus, and the abdominal organs were in the normal position.

CASE 34162

Presentation of Case

A forty-eight-year-old chauffeur entered the hospital because of pain in the right elbow.

One year before entry the patient had a painful right upper arm for a few weeks following a strain in breaking a fall. He recovered completely from this episode, however, and remained asymptomatic until one month before entry, when he slipped and twisted the right arm while shoveling snow. He immediately sustained severe pain around the elbow, with radiation to the outer aspect of the right shoulder. The pain gradually subsided and disappeared a week later, when he first noted swelling of the "muscles" just above the elbow. Two weeks before entry physical examination and x-ray studies demonstrated a "tumor" of the lower humerus. One week later he slipped and fell and felt a crack in the arm, with resulting severe pain. X-ray films were taken, the arm was splinted, and he was sent to this hospital.

His father had died of carcinoma of the liver, and an uncle had carcinoma of the stomach.

The patient allegedly had enjoyed excellent health and denied weight loss, systemic symptoms, previous trauma or bone disease.

Physical examination revealed a well developed and well nourished man with moderate pitting edema below the lower third of the humerus, a swelling around the elbow and a soft-tissue mass, 2.5 by 5 cm., above the medial epicondyle, in the region of which there seemed to be some abnormal mobility. There was no discoloration of the skin and no evidence of motor or sensory impairment. A few firm, nontender lymph nodes (0.5 to 1.0 cm. in diameter) were palpated bilaterally in the groin. No abdominal masses or chest abnormalities were demonstrated.

The temperature was 98°F., the pulse 76, and the respirations 15.

Examination of the blood showed a hemoglobin of 15.1 gm. per 100 cc. and a white-cell count of 11,400, with 79 per cent neutrophils. Urinalysis was negative. No Bence-Jones protein was found.

X-ray films of the right humerus demonstrated a destructive process 10 cm. long in the distal third through the entire thickness of bone but with no spicule formation, no new-bone formation, and no periosteal elevation; there was a pathologic fracture through this area. The medulla above the lesion had some irregular areas of mottling, and the cortex appeared roughened (Fig. 1). Scout films of the chest, spine, pelvis, left arm and both legs were normal.

An operation was performed.

Differential Diagnosis

Dr. Clifford C. Franseen: In the differential diagnosis of any suspected bone tumor, Dr. Channing Simmons has taught us to review the history and the signs and symptoms from three aspects: infectious, metabolic and neoplastic. The age (forty-eight years) is important to consider, as it is in any case of suspected bone tumor, and I shall deal with this later. This man either led a precarious existence or was very clumsy, because he suffered so many injuries from falls. Possibly, a neurologic examination would have thrown some light, but we do not have this information.

Let us consider infectious lesions first. With respect to osteomyelitis, the temperature was normal, and there was no suggestion of local inflammation. The record does not suggest a chronic inflammatory lesion, such as Brodie's abscess, especially by x-ray study. There was a slight elevation of the white-cell count, but little else to suggest that this process had arisen on the basis of osteomyelitis. In the latter lesions, also, enough reactive new-bone formation usually accompanies the osteomyelitis so that pathologic fracture is uncommon.

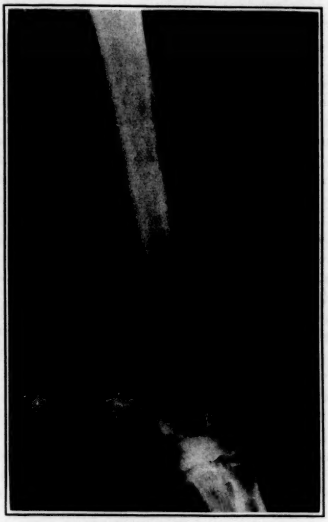

Figure 1.

Syphilis must be considered only because it can simulate practically any bone lesion. The blood Hinton test is not given. We do not know whether or not it was taken, but, of course, it should be included in any study of a bone lesion. Syphilis, as a rule, produces considerable periosteal reaction, which was minimal or absent in this case. Tuberculosis can only be mentioned — we cannot rule it in or out in this case except for the statistical rarity of an isolated lesion in the humerus, especially since the chest film was normal.

We must consider the neoplastic group of diagnoses more seriously. The character of the destruction suggests that this was a neoplastic lesion, and probably a malignant one. Benign tumors that should first be considered are lesions such as bone cysts. They usually occur in the young age groups, and usually the first knowledge of their presence is the occurrence of pathologic fracture, unless they are picked up incidentally by an x-ray examination. It would be unusual for a man of this age to have one. A giant-cell tumor may remotely be suggested by the x-ray film, but the site in the bone is not a usual one. Perhaps we should see the x-ray films, since their interpretation becomes more important from now on.

DR. STANLEY M. WYMAN: The lesion described lies in the lower third of the humerus (Fig. 1) but does not extend down to the condyles. It seems to be a purely destructive process. There is no visible new-bone formation and no evidence of periosteal reaction. The roughening of the cortex is seen on either side of the shaft, much higher on the humerus. The spine, both femurs and the bones of the pelvis and lumbar spine show no definite disease. The lung fields are clear; the heart is not remarkable. I cannot make any statement about the abdominal viscera. The film is not of diagnostic quality.

DR. FRANSEEN: Is the mottling in the center merely an area of irregular bone destruction, with no evidence of trabeculation?

DR. WYMAN: I interpret the mottling as bone destruction, with residual areas of medullary trabeculation and some areas of residual cortex remaining between the areas of destruction. I think the process may have started centrally and extended to involve the entire thickness of the bone.

DR. FRANSEEN: The x-ray appearance is different from what I had visualized from the written description. I did not appreciate that the periosteal reaction was so far away from the main lesion.

To continue the discussion, I can say that I am not familiar with any giant-cell tumor that has taken on an appearance such as this even when a pathologic fracture has occurred through it. If we, then, go on to consider other primary malignant tumors, Ewing tumor must be thought of. In this respect, again, the age of the patient is very important. I know of no case of Ewing tumor in this age group, but as in any bone lesions, it can perhaps occur. I met Dr. Simmons just before this conference and asked him if he remembered any patient with Ewing tumor in this man's age group, but he could remember none. Geschickter and Copeland* have reported no case in a patient so old as this man. We have all seen bizarre x-ray pictures in Ewing tumor, but there is no suggestion here of lamination of the periosteum or the other signs that are usually associated with this tumor. As you perhaps know, at least 50 per cent occur in adolescence, with tapering off of the age incidence at either end. The tumor rarely occurs in the thirties. Age in itself is a strong argument against a Ewing tumor in this case, but, again, one cannot exclude it entirely.

Multiple myeloma should be considered, but this patient at forty-eight is not too good a candidate for it. This lesion is not the purely destructive lesion by x-ray study that one usually associates with multiple myeloma, and to have an isolated lesion in an extremity without evidence elsewhere would be extraordinary in multiple myeloma. In this disease the serum protein is sometimes elevated, but we do not have this determination to help us. The character of the patient's pain, which showed remissions between aggravations by trauma, is suggestive of multiple myeloma in a general way, but these are about the only facts I can find in its favor. There was no Bence–Jones protein in the urine and no evidence of nephritis on urinalysis; the latter frequently accompany the lesion. So much for multiple myeloma.

Considering other malignant bone tumors, malignant tumors of cartilaginous origin usually show some trabeculation, and this lesion, according to the x-ray interpretation, gave no suggestion of trabeculation, but rather irregular mottled areas of destruction. The osteolytic form of osteogenic sarcoma must more seriously be considered in a destructive lesion such as this appeared to be. There was not enough new-bone formation to consider the osteoblastic form of osteogenic sarcoma. The osteolytic form can begin subcortically and, as it gets larger, extend to a more central position, as in this case. Pathologic fracture, as in this case, is common. However, osteogenic sarcoma, as Dr. Simmons has pointed out so frequently, is uncommon at this age unless associated with Paget's disease. However, there is some overlapping of age groups, and osteolytic sarcoma cannot be excluded on the basis of age alone. Reticulum-cell sarcoma must also be considered, and I would be unable definitely to exclude this lesion without a biopsy. I see no reason to consider other bone-destructive lesions such as eosinophilic granuloma. I have had no personal experience with them, but know that they usually occur in much younger age groups, particularly in children.

In the neoplastic group, we are then left to consider secondary or metastatic lesions of bone. A secondary lesion of Hodgkin's disease taking this form, without any other evidence of it elsewhere, would be very uncommon because bone involvement of this type would usually occur only in late stages of the disease. I think we can disregard the lymph nodes described in the groins, because, in my experience, nodes of this description can be felt in almost any person, so that I see no reason for considering Hodgkin's disease seriously.

*Geschickter, C. F., and Copeland, M. M. *Tumors of Bone.* 709 pp. New York: *American Journal of Cancer*, 1931. P. 640.

I think, however, that metastatic carcinoma must be considered very seriously, since the picture is entirely consistent with that diagnosis. In a woman, the breast would, of course, be regarded as a primary source, but this man's breast was presumably easily examined, and a carcinoma would have been discovered if present. The most common sources to consider in this case are the prostate and kidneys. Metastases from prostatic carcinoma are apt to show more osteoblastic activity than this lesion did, but some that we have seen have been almost completely osteolytic. An isolated metastasis like this in an extremity is uncommon in carcinoma of the prostate. Renal-cell carcinoma frequently produces a soft, pulsating tumor. In this case there is no description of the consistence of the tumor. The few that I have seen have been confined especially to the sternum and upper end of the humerus. This site, in the lower end of the humerus, is more unusual. The metastases from renal-cell carcinoma are often a more expanding type of tumor than this — this tumor mass was only 2.5 by 5.0 cm. That is as far as I can go, since nothing is said in the record about examination of the prostate or kidneys.

I had the impression as I first read through the record that the most likely diagnosis would be an osteolytic form of osteogenic sarcoma. On looking at the x-ray films, however, a metastatic lesion seems more likely. In any lesion like this, we have been taught that the only approach is to consider it a malignant lesion of bone until proved otherwise, and that the only method by which an exact diagnosis can be made is by biopsy with preparation for amputation if the lesion proves to be malignant. If I have to make a definite diagnosis from the appearance of the x-ray film, I say that this was probably metastatic carcinoma, and that is as far as I am willing to go.

Clinical Diagnosis

Sarcoma, (?) reticulum-cell type.

Dr. Franseen's Diagnosis

Metastatic carcinoma.

Anatomical Diagnosis

Metastatic renal-cell carcinoma.

Pathological Discussion

Dr. Edwin F. Cave: I saw this man after he had been admitted to the Baker Memorial Hospital. He was wearing a splint on the right arm. He had a fracture through the diseased area of the lower end of the humerus, and a good deal of swelling of the distal end of the arm and elbow. We could not make an accurate diagnosis, so we did a biopsy, separating the muscles, which were edematous. The radial nerve was retracted, and we came into the fracture line. The bone was spongy and rather necrotic, the medulla was easily entered, and we took specimens from the cortex, the medulla and the periosteum. An attempt was made to do frozen sections at the time, but nothing conclusive was determined from the sections, so we closed the wound and waited for a report.

Dr. Tracy B. Mallory: The tumor in this case was extensively necrotic, and not until the permanent sections were cut were we able to find areas suitable for diagnosis. When we finally got some viable tumor it was quite evident that we were dealing with carcinoma, with large, clear, vacuolated cells very strongly suggestive of renal origin. Will you go on from there, Dr. Cave?

Dr. Cave: We debated then whether we should study the patient further by doing an intravenous pyelogram. Dr. Grantley Taylor was asked to see him, and he agreed that amputation was indicated and we proceeded with that. Amputation was done about two weeks after the biopsy. We amputated through the surgical neck of the humerus. The wound healed primarily. After that Dr. Chute and Dr. Colby saw the patient, and renal studies were done.

Dr. Mallory: Dr. Wyman, will you show the pyelogram?

Dr. Wyman: The pyelogram shows a tumor in the upper portion of the kidney, displacing the calyxes.

Dr. Richard Chute: I was presented with this problem on account of the fact that a number of cases have been reported in which a solitary metastasis from a renal-cell carcinoma has been removed and later the original source found and removed, and the patient remained "cured" for a good number of years. It seemed to us reasonable to extirpate the focus; therefore, Dr. Soutter and I did a nephrectomy. Dr. Soutter might like to say something about the technic and the result.

Dr. Lamar Soutter: This is the third case of a transthoracic nephrectomy done in this hospital for carcinoma. The reason for using this approach is that it provides more room for radical surgery. The exposure is better to cut the renal vein on the right side of the spine and the renal artery at the aorta and to remove the regional lymph nodes and the adrenal gland. That was done in this case.

Dr. Mallory: The amputated arm showed a mass of necrotic tumor, again with recognizable areas of renal-cell adenocarcinoma, and the resected kidney showed characteristic hypernephroma. The tumor was extensive enough to have invaded the renal vein and extended along nearly two thirds of the way to the vena cava as they often do.

The patient is still convalescing on the wards and is doing well.

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FEDERAL SUPPORT FOR MEDICAL EDUCATION

"THE philosophies of one age have become the absurdities of the next, and the foolishness of yesterday has become the wisdom of tomorrow." Half a century ago Osler[1] thus indicated the fluctuations of thought with which men sometimes measure their problems and devise their solutions. The problems are always vivid and immediate, whereas their solutions seem limited — so limited that men find themselves able to move in only one direction or not at all. Wars become inevitable, and so do Government subsidies; but is this wisdom or is it foolishness? Medical education in the United States is today based upon the highest standards in the world, and yet whenever it is surveyed it is easily shown to be inadequate and in immeasurable need of improvement. In a less prodigal age we should have said that we were living far beyond our means, but none is living beyond his means today until he has completely exhausted all chance of Government support. The air is full of talk of such support for medical students, medical research, medical education and medical practice.

The American Academy of Pediatrics has recently released a recommendation for federal support of pediatric education.[2] The figures presented are said to reveal a startling lack of adequate training on the part of those who are caring for children. On the other hand if such figures were broken down into groups of those whose hospital training or lack thereof was received ten, twenty and thirty or more years ago, it might become apparent that we are on the very crest of a wave of improvement in pediatric training as judged by time spent in pediatric hospitals after graduation from medical school. Certainly there are more candidates than there are opportunities for approved residency training in pediatrics, and in all the other specialties as well. When one turns to the need for more physicians trained in the care of children in the remote and rural areas, fellowships are suggested for medical graduates "committed to return to practice in an area of need." Many have tried, but no good answer has yet been framed for the old question of how they are to be kept down on the farm. The cost of medical education to the student is also cited as a reason why there may be a tendency on the part of young doctors to renounce special training or to settle in the urban areas where professional life may be economically easier. The recommendations are specific: that an appropriation of $5,000,000 be authorized, to be administered by the Federal Security Administration in direct support of pediatric education. Half of this would go to the departments of pediatrics of the approved medical schools in accordance with need and student enrollment. One and a half million dollars is recommended for scholarships and fellowships or other purposes directly related to pediatric education, and $1,000,000 is recommended for allocation to states in need because of their remote and rural areas into which physicians cannot now be induced to move.

Other specialties occupy educational grounds no less valid and deserving; what would be the tendency for them to generate equalizing pressures? Medical schools are constantly being surveyed by professional groups gathering data about this or that special interest. Such surveys are generally followed by reports indicating the existing inadequacies and suggesting minimum standards. It is as though our leaders were busying themselves by seeking to perfect each small part of a mosaic, but neglecting to concern themselves with the over-all picture or the condition likely to supervene ten years hence.

That the eyes of different groups are not focused upon the same objective is emphasized by recent divergent estimates concerning the likelihood of a shortage of physicians by 1960.[3] The United States Public Health Service and the Federal Security Administration anticipate a shortage of between 30,000 and 50,000 doctors in another decade, whereas the American Medical Association estimates that by 1960 there will be in this country at least 1 physician for every 700 people — a greater ratio than at present or in the immediate past. The number of physicians is increasing at a relatively more rapid rate than that of the population as a whole. This would be all right if there were to be more for them to do in the coming era than there has been in the past. If there are to be vast increases in hospital and research facilities more medical manpower will be needed. On the other hand, too many physicians, like too many cooks, could be a menace to the people's health, especially if it is necessary to sacrifice quality to produce the larger number, and if they must eke out a living by private practice in this apprehensive and neurotic world.

Whether an extension or permanent modification of the present GI bill of rights for all medical students would be helpful (and to whom) is another large subject. Such an extension would not produce more doctors. It might make medical education available to students who would otherwise seek a different training or vocation. It would surely attract the type of student whose hat is in the ring for a scholarship. Medicine has need for the best brains that can be recruited; it also needs character. Brains are more easily measured than character, but character motivates and guides the application of brainpower, and is therefore recognized as a raw material without which a good doctor cannot be educated regardless of the resources at his disposal. If a formula could be devised that would recognize and attract character as readily as brains are now recognized, medical educators would find the task of selecting students greatly lightened and better performed than at present.

Expansion of federal largess is potentially without limit — but there is a fly in the lard. The members of the medical profession are not unanimously convinced that Government support can be contrived without Government interference. In a recent Washington Report[4] an aide of the Federal Security Administrator is quoted as asking the question: "Why must Uncle Sam ever be suspected, when he lends a helping hand, of having something up his sleeve?" Whoever can answer this question can also tell us whether all this is wisdom or foolishness.

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3. Editorial. Is there shortage of physicians? *J. A. M. A.* 136:626, 1948.
4. Washington Report, No. 39, dated March 1, 1948.

THE WORLD MEDICAL ORGANIZATION

Possibly unnoted by many, in the present confused and disturbed condition of the world, was the announcement from the recent Interim Session of the House of Delegates of the American Medical Association in Cleveland on the formation of a World Medical Organization.

This was agreed to in principle at the Atlantic City Annual Session in June, 1947, and authority for participation wholeheartedly voted by the House of Delegates. The organization meeting was held in Paris in September, with four members of the Board of Trustees as the American representatives. One hundred and twenty-five delegates from forty-eight nations attended. From the reports on the sessions, one gathers that some of the meetings resembled those held by the United Nations at Lake Success. Apparently, there were many trying moments when "patience, tolerance, long-suffering

and vision were required" — not to be wondered at when one considers the diversity of tongues, suspicions and fears. Apparently, Drs. Henderson, Bauer, Irons and Sensenich did a splendid piece of medical statesmanship. The details of the organization need not be reviewed here but should be read in the January 17 issue of the *Journal of the American Medical Association*, where they are briefly set forth.

A few essentials may be stated. This newly formed organization constitutes a potentially important agency for peace as well as health. It is to be distinguished from the World Health Organization, which is part of the United Nations set-up. It is to the medical picture what the American Medical Association is to American medicine, and the World Health Organization of the United Nations in that picture is comparable to the United States Public Health Service. Under the present temporary organization, illustrative of its broad international scope, the president is from Paris, the president-elect from Czechoslovakia, the treasurer from Switzerland, and the ten elected members of the General Council from England, Sweden, France, Spain, Australia, India, China, Cuba, Canada and the United States. The permanent secretariat is to be in New York City at the Academy of Medicine.

This organization may well prove to be the first step toward a better understanding among nations, and, if so, it will be of inestimable value. As has been well said, "If the doctors in the world cannot get together, it is doubtful if anyone can."

DISPLACED PERSONS

Members of the medical profession are commonly accused of taking less interest in world affairs than the average responsible man with the same degree of education. It would be truer to say that specialized training has taught physicians the value of accurate detailed facts and the practical difficulty of obtaining them. Factual information about the 850,000 homeless people in Europe has recently been issued in a twenty-six-page pamphlet by the Citizens Committee on Displaced Persons with a view to clarifying the world problem that their plight has created.

These European ex-slave laborers have put the United States in a very embarrassing position indeed. It is *our* opposition to their forcible repatriation to Soviet-dominated countries and *our* insistence on their right to a home in a free country that is keeping them in concentration camps three years after the date of "liberation." To be sure, we are paying the bills. The camps in Germany and Austria are likely to cost us a quarter of a billion dollars in 1948. Not only our national economy but also our international reputation for good faith is being damaged. Fifty-three times in three months has the Soviet propaganda office broadcast the story to the world of how our great humanitarian democracy is letting its former allies rot in camps for displaced persons. France, Belgium and the United Kingdom have already admitted 6000, 20,000 and 24,000 displaced persons, respectively, as immigrants and have agreed to admit 69,000, 66,000 and 80,000 more in the immediate future. Other democracies have made similar commitments. The United States has admitted 22,000 and is now debating whether to admit any more.

It is not necessary to be vague regarding the type of persons represented. They have recently been investigated in their camps by a special nonpartisan committee of the House Foreign Affairs Committee and are being surveyed by a similar committee of the Senate. They are Poles, Latvians, Lithuanians, Estonians, Yugoslavs, Greeks, Ukrainians, Czechs and Jews — all homeless and all certain of persecution or death in their former countries. Half are women and children, almost all are young, and many are skilled. For example there are 21,175 skilled construction workers, including architects, draftsmen, surveyors, electricians and carpenters, 38,654 persons trained in the professions (teachers, musicians, librarians, nurses, physicians, artists, lawyers, engineers and so forth), 95,427 agricultural workers and many other representatives of valuable skills and trades listed in the most recent census. Investigators report them to be good citizenship material.

An emergency bill is before Congress (Stratton Bill, HR 2910) to admit approximately half the displaced persons to the United States by increasing the annual immigration quota for a period of four years. First priority would be given to the relatives

of United States citizens and veterans. If all who could qualify under our basic immigration laws were admitted they would amount to only 0.3 per cent of the population, or less than half the quota of immigrants whose admission to this country was prevented during the four war years. Secretary of State Marshall strongly favors this action and says, "Now is the time to act." Robert P. Patterson states that, "on the grounds of economy, humanity and the furtherance of the world peace," Congress should enact HR 2910. The presidents of the AFL and CIO believe that such action "will not have any adverse bearing on the American workman" and that "the DP's would in fact stimulate employment." Earl G. Harrison, former commissioner of immigration and now dean of the University of Pennsylvania Law School and chairman of the Citizens Committee on Displaced Persons has made the following comment:

> Our rate of population growth has been slowing up and our population has been growing older. Immigration gave us strength and nourishment when we were young in the family of nations. It can help us again. It can give us the strong, vigorous population needed to maintain our leadership among world powers.

Justice Owen J. Roberts adds:

> If we are serious in our concern for personal freedom, we must prove it by action. If we make the gesture for DP's, other countries will follow our lead.

The humanitarian aspect of this situation is easy enough to comprehend. The political, economic, financial and international phases are being clarified by the information now becoming available. A great many people whose opinions deserve unqualified respect believe that the Stratton Bill should be passed, and passed at once. We have become accustomed to suspect a joker in most election-year legislation, but it is difficult to find a joker in this bill.

THE FALLACY OF THE CRUDE DEATH RATE

In a statement released by the Federal Security Administrator, Oscar R. Ewing, the crude death rates for the various states were discussed. In 1945 the death rate for the country as a whole was 10.6, whereas in 1946 it was 10.0. The reported rate for Massachusetts dropped from 12.2 to 11.2, although there was an actual increase of 265 deaths. The only explanation for a decreased death rate with a practically constant number of deaths would be an increase in the population. Demobilization of troops caused an increase, but the extent is problematical, and at the present time estimated populations must be used in the determination of rates. Considerable error may also be found in such estimations when shifts in population have affected a large proportion of the people, such as occurred among civilians during the war years. Until the next census is taken, rates can only be approximated, and little significance should be placed in a reported drop in the crude death rate from 12.2 to 11.2.

The variations in the rates in different parts of the country are influenced by age, sex and race differences. An older part of the country, such as New England, is expected to have a higher death rate than that of the more recently settled communities. If valid comparisons of mortality risk are to be made, adjustments are necessary to allow for differences in population structure. It is interesting to note that, despite the many changes in the trends of individual disease as well as population changes, the total number of deaths in Massachusetts has remained fairly stationary for the last quarter century, averaging about 50,000 deaths per year.

MASSACHUSETTS MEDICAL SOCIETY

DEATHS

Barton — John A. Barton, M.D., of Fitchburg, died recently. He was in his seventy-fourth year.

Dr. Barton received his degree from Harvard Medical School in 1897. He was head of the Eye, Ear, Nose and Throat Department of the Burbank Hospital for thirty years, and was a member of the New England Otological and Laryngological Society.

His widow, a son and a granddaughter survive.

Ellis — Arthur H. Ellis, M.D., of Greenfield, died on March 4. He was in his sixty-seventh year.

Dr. Ellis received his degree from Dartmouth Medical School in 1907. He was a former president of Franklin District Medical Society and was a member of the staffs of Franklin County Public Hospital, Greenfield, and Farren Memorial Hospital, Montague City, and a fellow of the American Medical Association.

His widow, four daughters and six grandchildren survive.

Everett — Frederick L. Everett, M.D., of Springfield, died on March 6. He was in his seventy-sixth year.

Dr. Everett received his degree from Cornell University Medical College in 1902.

His widow, two daughters and nine grandchildren survive.

FISH — John E. Fish, M.D., of Canton, died on March 30. He was in his seventy-fifth year.

Dr. Fish received his degree from Dartmouth Medical School in 1896. He was a former president of Norfolk District Medical Society and was formerly superintendent of the Massachusetts Hospital School in Canton. He was a fellow of the American Medical Association.

His widow, two daughters and two sons survive.

HOSLEY — Walter A. Hosley, M.D., of Topsfield, died on March 25. He was in his seventieth year.

Dr. Hosley received his degree from Harvard Medical School in 1904.

Two daughters survive.

HUNT — Reid Hunt, M.D., of Boston, died on March 7. He was in his seventy-eighth year.

Dr. Hunt received his degree from College of Physicians and Surgeons of Baltimore in 1896. He was associate professor of pharmacology at Johns Hopkins University School of Medicine from 1898 to 1903, chief of the division of pharmacology, United States Public Health Service, from 1904 to 1913 and professor of pharmacology at Harvard Medical School from 1913 to 1936. He was professor of pharmacology, emeritus, Harvard Medical School, a former chairman of the Council on Pharmacy and Chemistry of the American Medical Association and a member of the Association of American Physicians.

His widow survives.

IRWIN — Vincent J. Irwin, M.D., of Springfield, died on February 26. He was in his sixty-first year.

Dr. Irwin received his degree from Yale University School of Medicine in 1909. He was a member of the American Academy of Ophthalmology and Oto-Laryngology and a fellow of the American Medical Association.

His widow survives.

LELAND — Leslie P. Leland, M.D., of Worcester, died on March 16. He was in his sixty-fourth year.

Dr. Leland received his degree from Boston University School of Medicine in 1909. He was a former secretary of the Worcester District Medical Society and was a member of the New England Obstetrical and Gynecological Society and a fellow of the American Medical Association.

His widow and two daughters survive.

MAY — James V. May, M.D., of Belmont, died on December 24, 1947. He was in his seventy-fifth year.

Dr. May received his degree from University of Pennsylvania School of Medicine in 1897. He was a former president of the New England Society of Psychiatry, Massachusetts Psychiatric Society and American Psychiatric Association, and was a fellow of the American Medical Association.

O'BRIEN — John C. O'Brien, M.D., of Greenfield, died on March 18. He was in his eighty-fifth year.

Dr. O'Brien received his degree from University of Vermont College of Medicine in 1887. He was formerly a trustee of the Northampton State Hospital, town physician and physician to the Greenfield House of Correction, and was a fellow of the American Medical Association.

A son and a daughter survive.

MEDICOLEGAL ABSTRACT

Relation of Patient and Physician — Confidential communications and their possible disclosure in hospital records. According to the terms of his oath the physician is bound to treat the communications of his patient in confidence. Legally, however, no such privilege existed under the common law. In some states, however, statutes have protected confidences revealed to the physician for the purpose of adequate diagnosis and treatment. In states where such confidences are protected by statute the question may arise to what extent, if any, the protection is removed if the information revealed to the physician in confidence is made a part of a hospital record. Such a question was recently considered by the Supreme Court of Ohio.

In a proceeding in which it was sought to show that a will was invalid on the ground that the testator lacked the necessary mental capacity, hospital records were offered, consisting of the entrance slip, the physician's direction for the medication to be administered and treatment to be given the patient by the nurses, record of analyses of the blood and the urine of the patient and the day-to-day chart made and kept by the nurses who had charge of the patient while he was at the hospital. These charts recorded the food and medicine given and the condition and behavior of the patient; the fact that he was irrational at times; that he left his bed at unreasonable hours; that on one occasion he used a wastepaper basket as a commode; and that on several occasions he became unruly. Part of the record included notations of increasing administrations of sedatives culminating on the date that the will was signed. These portions of the record were all admitted in evidence. A verdict was returned that the writing in question was not valid as the last will and testament of the deceased, and judgment was entered for the contestant. The contestees sought a reversal on the grounds that the hospital record contained matters communicated confidentially to the physician and nurses of the deceased and should not have been admitted in evidence.

Ohio has statutes establishing a patient-physician privilege and also providing for the admissibility of hospital records, but the statutes do not specify the relation between the two. The court discussed the question whether or not the communications should have been admitted even though it found that the contestees had waived their privilege by permitting the physician to testify completely and without objection to all details of his diagnosis and treatment. However, the court stated:

> The courts in most states having Physician-Patient Privilege Statutes similar to section 11494, General Code, generally hold that communications between Physician and Patient, not in the presence of third persons, for the purpose of diagnosis and treatment of the patient, if carried into a private hospital record or chart, remain confidential, and that such part of the chart or record is inadmissible in evidence unless the privilege is waived.

In discussing generally the admissibility of hospital records the court said:

> Such a hospital or physician's office record may properly include case history, diagnosis by one qualified to make it, condition and treatment of the patient covering such items as temperature, pulse, respiration, symptoms, food and medicine given, analysis, of the tissues or fluids of the body, and the behavior of and complaints made by the patient.

The court drew a line between direct communication and observed facts or information obtained without communication. The difficulties in determining admissibility according to such a line of demarcation are evident. Portions of the record that report diagnosis and directions for treatment do not fall into either of the categories described by the court. Is the diagnosis admissible? And of what use is it to bar the communications on which diagnosis is based when the diagnosis and medication and directions for treatment clearly indicate the substance of the barred communication? In this case, therefore, part of the records included notations of increasing administration of sedatives that would be confidential if related to the physician by the patient but perhaps avoids the privilege when entered on the hospital record as an observed fact.

If the entire hospital record is admissible in evidence the purpose of the statute and of the physician's oath would be nullified, and professional confidence would be limited to unrecorded information. (*Weis* v. *Weis*, 72 N. E. [2nd] 245, 1947.)

MISCELLANY

AMERICAN COLLEGE OF SURGEONS APPROVES USE OF NURSE ANESTHETISTS

The Board of Regents of the American College of Surgeons, at a meeting on February 22, adopted the following resolution:

The American College of Surgeons regards with deep concern the actions of some physician anesthesiologists in giving the impression to the laity in the public press that it is unsafe for experienced nurse anesthetists to conduct surgical anesthesia. While it supports the increasing tendency of having physician anesthesiologists in charge of surgical anesthesia, it deplores at this time any propaganda for the elimination of the trained nurse anesthetist. On the contrary, the Americal College of Surgeons is of the opinion that, in view of the inadequacy in number of the physician anesthesiologists and in view of the splendid record of achievement of the nurse anesthetists, institutions engaged in the training of nurses for this purpose should be encouraged to continue their programs.

NATIONAL CANCER INSTITUTE

More than $1,355,818 in federal grants-in-aid from Public Health Service funds for cancer research and control has been announced by the Federal Security Administration. It was made on the recommendations of the National Advisory Cancer Council of the National Cancer Institute. Another $8,000,000 in construction grants for new laboratory and clinical facilities has been recommended by the Council.

NOTE

Dr. Arthur Marvel Lassek, head of the Department of Anatomy, Medical College of the State of South Carolina, in Charleston, since 1933, has been appointed Waterhouse Professor of Anatomy at Boston University School of Medicine, effective July 1. Dr. Lassek will succeed Dr. Jesse LeRoy Conel, a member of the medical faculty since 1923.

CORRESPONDENCE

RESTORATION OF LICENSE

To the Editor: At a meeting of the Board of Registration in Medicine held March 18, it was voted to restore the registration to practice medicine to Dr. George J. Orlansky, 20 Charlotte Road, Newton Centre (formerly of 1234 Blue Hill Avenue, Dorchester).

H. QUIMBY GALLUPE, M.D., *Secretary*

State House
Boston

DEPRIVATION OF LICENSE

To the Editor: At a meeting of the Board of Registration in Medicine held March 18, it was voted to suspend the registration of Dr. William P. Pratt, 28 Adams Street, Quincy, for three months.

H. QUIMBY GALLUPE, M.D., *Secretary*

State House
Boston

BOOKS RECEIVED

The receipt of the following books is acknowledged, and this listing must be regarded as a sufficient return for the courtesy of the sender. Books that appear to be of particular interest will be reviewed as space permits. Additional information in regard to all listed books will be gladly furnished on request.

An Atlas of Anatomy. By J. C. Boileau Grant, M.C., M.B., Ch.B., F.R.C.S. (Edin.), professor of anatomy in the University of Toronto. Second edition. 4°, cloth, 496 pp., with 591 illustrations. Baltimore: Williams and Wilkins Company, 1947. $10.00.

This atlas was published first in 1943 and reprinted in 1944 and 1945. Dr. Grant, in this edition, has added more than two hundred illustrations, including the wrist, superficial veins of the limbs, the inguinal region, abdominal viscera, suprahyoid region, mouth and the blood supply of the esophagus, stomach, duodenum, pancreas, bile passages, spleen and suprarenal glands. Also, the more common dissecting-room variations, the epiphyses and schemes of the distribution of the cranial nerves and of the motor nerves to the extremities are considered. A good index concludes the volume. The book is well published in every way. The illustrations and color work are excellent. The atlas is recommended for all medical libraries.

Overcoming Stammering. By Charles Pellman. With a foreword, by Frederick Martin, M.D., director of National Institute for Voice Disorders, Bristol, Rhode Island, and director of Speech Clinics, State Department of Education, Rhode Island. 8°, cloth, 160 pp. New York: The Beechhurst Press, 1947. $3.00.

Mr. Pellman, an experienced practicing speech correctionist, analyzes and evaluates current methods of speech correction and treatment. He presents a plan for speech correction of stammering and stuttering based upon the physiology of speech and proper mental hygiene, rather than on the functioning of the speech apparatus. His method may be used in the home by intelligent parents. The text ends with an autobiographic sketch of a stammerer by Aaaro Pellman. A list of books and an index conclude the volume. The book is well published. It is recommended for medical and educational libraries.

Procedure in Examination of the Lungs, with Especial Reference to the Diagnosis of Tuberculosis. By Arthur F. Kraetzer, M.D., associate attending physician, Lenox Hill Hospital, physician to out-patients, New York Hospital, and instructor in medicine (dermatology), Cornell University Medical College. Third edition, revised and with a preface by Jacob Segal, M.D., medical director, Los Angeles Sanatorium. *Oxford Medical Publications*. 8°, cloth, 150 pp., with 16 illustrations and 14 plates. New York: Oxford University Press, 1947. $3.50.

Dr. Segal, in this revision of Kraetzer's manual, has brought the subject up to date since the publication of the previous edition in 1935. The text of the second edition has not been disturbed, but the new material has been incorporated in an appendix of twenty-two pages and sixteen x-ray plates. An x-ray commentary on the correlation of signs leading to a diagnosis, with histories of 13 cases and illustrated with the x-ray pictures, is included in the appendix. An index has been added for the first time. The volume is well printed with good type, on good paper.

The Dispensatory of the United States of America. By Arthur Osol, Ph.G., M.S., Ph.D., professor of chemistry and director of the department of chemistry, Philadelphia College of Pharmacy and Science; and George E. Farrar, Jr., M.D., associate professor of medicine, School of Medicine, Temple University, and chief of Medical Service A, Episcopal Hospital. 4°, cloth, 1928 pp. Philadelphia: J. B. Lippincott Company, 1947. $16.50.

This standard reference work has a remarkable record of one hundred and fifteen years of continuous publication. It was first issued in 1833 as *The Dispensatory of the United States of America*, by Drs. George B. Wood and Franklin Bache. In 1879, with the fourteenth edition, Dr. H. C. Wood became associated with the elder Dr. Wood, and in 1885, with the fifteenth edition, Dr. H. C. Wood became the principal author. With the centennial edition Dr. H. C. Wood, Jr., became the principal author, and he is now advisory editor to this twenty-fourth edition. The work was issued every few years from the beginning, and a number of editions were reprinted, except that editions were not published during the Civil War years, 1859–1864. The text is divided into five parts. Parts one and two, the major portion of the work, describe the drugs recognized by the *United States Pharmacopœia, the Pharmacopœia of Great Britain* or the *National Formulary* and the drugs not official in these works. The drugs are listed alphabetically in these two sections. The remaining parts list general tests, processes, reagents and solutions; veterinary uses and doses of drugs; and tables of the *United States Pharmacopœia* or the *National Formulary*. The tables on atomic and molecular weights, and on equivalents of weights and measures are especially valuable. A comprehensive index concludes the volume. The publishing is excellent in every way. Every effort has been made to reduce the weight and size of such a large volume. The text is printed in two columns on a good light paper with a good type. The price is very reasonable for the size of the book. The work is recommended for all libraries, medical and general, and to all persons interested in drugs.

The Foot and Ankle: Their injuries, diseases, deformities and disabilities. By Philip Lewin, M.D., associate professor of bone and joint surgery, and acting head of department, Northwestern University School of Medicine, professor of orthopedic surgery, Post-Graduate Medical School of Cook County Hospital, attending orthopedic surgeon, Cook County Hospital, senior attending orthopedic surgeon, Michael Reese Hospital, and consulting orthopedic surgeon, Municipal Contagious Disease Hospital, Chicago. Third edition. 8°, cloth, 847 pp., with 389 illustrations. With line drawings by Harold Laufman, M.D. Philadelphia: Lea and Febiger, 1947. $11.00.

This edition of a standard work has been extensively revised in the light of the vast amount of information gleaned from the records and experience of World War II. Much material has been added, and emphasis has been placed on compound fractures, crushing wounds and osteomyelitis. There is a special chapter on the military aspects of foot and ankle disorders. The sections on traumatic gangrene and amputations have been enlarged, and ringworm has been considered not only as a primary and sole infection but also as a complication of injuries. There is a special chapter on psychosomatic medicine as it relates to certain orthopedic conditions. The book is well published and is recommended for all medical libraries and to all persons interested in the subject.

Diseases of the Nose, Throat and Ear. By William L. Ballenger, M.D.; and Howard C. Ballenger, M.D., associate professor and acting chairman, Department of Otolaryngology, Northwestern University School of Medicine, Chicago, and surgeon, Department of Otolaryngology, Evanston Hospital, Evanston, Illinois. Assisted by John J. Ballenger, M.D., research fellow in otolaryngology, Northwestern University School of Medicine, Chicago. Ninth edition. 8°, cloth, 993 pp., with 597 illustrations. Philadelphia: Lea and Febiger, 1947. $12.50.

This edition of an authoritative textbook has been revised by the addition of much material. Obsolete material has been deleted, and portions of the text rewritten and amplified. There is a new chapter on "headaches and neuralgias of the face," and rhinoplastic reconstruction has been described. The special contributors have revised the chapters on arytenoidectomy for bilateral paralysis of the current laryngeal nerves, physiology and functional tests of the labyrinth and inflammatory diseases of the labyrinth and peroral endoscopy. The volume is well published in every way. The printing of a history of the editions on the back of the title page would be of value to reviewers and other interested persons. The book is recommended for all medical reference collections.

Textbook of General Surgery. By Warren H. Cole, M.D., professor of surgery and head, Department of Surgery, University of Illinois College of Medicine, and director of surgical service, Illinois Research and Educational Hospitals, Chicago; and Robert Elman, M.D., professor of clinical surgery, Washington University School of Medicine, assistant surgeon, Barnes Hospital, associate surgeon, St. Louis Children's Hospital, and director of surgical service, H. G. Phillips Hospital, St. Louis. Fifth edition. 8°, cloth, 1160 pp., with 558 illustrations. New York: D. Appleton–Century Company, 1948. $11.00.

This standard textbook, first published in 1939 and last revised in 1944, in this new edition has been thoroughly revised to date. The type has been completely reset, and the volume repaged. The chapters on war and catastrophe surgery, surgical diseases of the chest and chemotherapy have been rewritten. The chapter on the nutritional requirements of surgical patients has been considerably expanded. A chapter has been added on surgical convalescence, including preoperative and postoperative care. The text is well written, and the material well organized. Selected references are appended to each chapter. Indexes of authors and subjects conclude the volume. The publishing is excellent except that the coated paper makes the volume heavy for its size. It is recommended for all medical libraries and all surgeons.

A Text-Book of Bacteriology. By R. W. Fairbrother, M.D., D.Sc. (Man.), F.R.C.P. (Lond.), director of the department of clinical pathology, Manchester Royal Infirmary, and special lecturer in bacteriology, University of Manchester. Fifth edition. 8°, cloth, 480 pp., with 34 tables and 6 plates. New York: Grune and Stratton, 1948. $6.50.

This textbook, first published in 1937, and last revised in 1946, has gone through twelve printings of the five editions, a fact that attests its soundness as a textbook for students. The author has made a thorough revision of the text for this fifth edition. The book is an outline of the medical aspects of bacteriology. The material is divided into three parts: general bacteriology, systematic bacteriology and general technic. A good index concludes the volume, which is well printed with a good type by the lithographic process on light paper.

Blood Pressure and Its Disorders, including Angina Pectoris. By John Plesch, M.D., Budapest, M.D., Germany, L.R.C.P. and S. Edin. and Glas. Second edition revised and enlarged. 8°, cloth, 307 pp., with 125 illustrations. Baltimore: Williams and Wilkins Company, 1947. $6.00.

Dr. Plesch has revised this second edition of his monograph, first published in 1944, by the addition of material, chapters and case histories. Selected references have been appended to each chapter. The text represents the author's personal experience and research, and is not intended as a comprehensive treatise on the subject. The printing was done in Great Britain and is excellent. The type and paper are good. The book should prove useful to physicians interested in the subject.

Biochemistry for Medical Students. By William V. Thorpe, M.A. (Cantab.), Ph.D. (Lond.), reader in chemical physiology, University of Birmingham. Fourth edition. 8°, cloth, 496 pp., with 36 illustrations. Baltimore: Williams and Wilkins Company, 1947. $5.00.

This English textbook, first published in 1938, and last revised in 1943, has been revised to date. A chapter on the use of isotopes in biochemical investigations has been added, and the sections on protein structure, coenzymes, flavoproteins, bile pigments and nutrition in wartime have been largely rewritten. The text is well written, and the material well organized. The type, printing and paper are excellent. The book should prove useful as an excellent summary of the subject.

Malaria, with Special Reference to the African Forms. By W. K. Blackie, M.D., Ph.D., F.R.C.P. (Edin.), D.T.M.&H. 8°, cloth, 104 pp., with a color plate. Cape Town: The African Bookman for the Post-Graduate Press, 1947. 10sh., 6d.

This concise monograph presents the latest methods of treatment with quinine and the newest plasmocidal drugs, including mepacrine (atabrine), pamaquin and paludrine. The first chapter comprises a short historical review, followed by chapters on the parasitology, pathology, clinical features, diagnosis, prognosis, treatment and prophylaxis of the various types of the disease. The material is well organized and well published in every way. The color plate depicting the various plasmodiae is excellent. A good index concludes the text. The monograph was published by the Bayer Pharma publication fund of the Cape Town Post-Graduate Medical Association. The work is recommended for all medical libraries.

Nursing in Modern Society. By Mary Ella Chayer, R.N., M.A., associate professor of nursing education, Teachers College, Columbia University. 8°, cloth, 288 pp. New York: G. P. Putnam's Sons, 1947. $4.00.

This book has been written primarily for nurses, teachers and supervisors. The various current problems of nursing are discussed by the author in the following divisions: the impact of social forces upon nursing; the influence of social forces upon community health needs; and building a better future for the nursing profession. Miss Chayer has called attention to the changing needs of society and to the changes that have already taken place in the nursing profession. The last chapter summarizes the twelve cardinal principles of professional service. The text is well written in an easy style, and the material is well organized. The type, paper and printing are excellent. A list of references and one of questions for study are appended to each chapter. A comprehensive general bibliography and a good index conclude the volume. The work should prove useful as a reference work in schools of nursing and as a textbook for postgraduate students. It is recommended for the reference collections of all medical libraries.

Benjamin Silliman, 1779–1864: Pathfinder in American science. By John F. Fulton, M.D., and Elizabeth H. Thomson. 8°, cloth, 294 pp., with seventeen illustrations. New York: Henry Schuman, 1947. $4.00.

Benjamin Silliman is of interest to the medical historian because of the responsible part he took in organizing Yale University School of Medicine in 1813. He was eminent as a chemist and geologist and as a teacher of science. He established the great Peabody Museum of natural history and founded the first gallery of fine arts in an American academic institution, the Trumbull Gallery of Yale College. He was also largely instrumental in founding the Sheffield Scientific School, first called the School of Applied Chemistry. The authors of this well written biography for the general reader cover the professional life of Silliman from the time he was appointed professor of chemistry at Yale in 1802 until his retirement in 1853. The story is told in an easy narrative style. The book is well published and should be in all medical and scientific historical collections. It is one of a series in *The Life of Science Library.*

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400 Years of a Doctor's Life. Collected and arranged by George Rosen, M.D., and Beate Caspari-Rosen, M.D. 8°, cloth, 429 pp. New York: Henry Schuman, 1947. $5.00.

This interesting anthology is made up of excerpts taken from formal autobiographies, letters and other writings of physicians, dead and living, of the past four hundred years. The material is arranged according to epochs and incidents in a doctor's life: early years; school days; medical-student days; the practice of medicine; scientist, scholar and teacher; the doctor marries; the doctor as a patient; the doctor goes to war; writing and politics; and reflections on life and death. The selections are preceded by short biographic notes or comments. The absence of direct references to the sources of the selections will be decried by the historian and bibliographer. A number of physicians appear more than once in different sections of the text, and there should have been an index to names to make the book useful as a reference work. The type, printing and paper are excellent. This unusual historical book should be in all collections of medical and general history.

Calcium and Phosphorus in Foods and Nutrition. By Henry C. Sherman, Ph.D., Mitchill Professor of Chemistry, emeritus, Columbia University. 8°, cloth, 176 pp., with seven figures and twelve tables. New York: Columbia University Press, 1947. $2.75.

This semipopular monograph presents in plain language a summary of the place of calcium and phosphorus in present-day nutrition. The first chapter discusses the role of calcium and phosphorus in nature, in agriculture and in human nutrition. The following chapters deal with calcium in the body; the effects of food and growth upon the calcium content; chemical forms and nutritional functions of phosphorus; calcium and phosphorus requirements and the problem of necessary and optimal intakes; and foods as a factor in the nutritional provision of calcium and phosphorus. An extensive bibliography of forty-four pages is appended to the text. A good index concludes the volume. The text is well written in a pleasing style, and the material is well organized. The publishing is excellent. The printing is well done with a good type on a good, light paper. The volume is recommended for all medical and general libraries and to all persons interested in the subject.

Surgical Disorders of the Chest: Diagnosis and treatment. By J. K. Donaldson, M.D., associate professor of surgery and in charge of thoracic surgery, University of Arkansas School of Medicine, and member of surgical staff, St. Vincent's Infirmary and visiting staff, Baptist Hospital, Little Rock, Arkansas. Second edition, thoroughly revised. 8°, cloth, 485 pp., with 146 illustrations and 2 color plates. Philadelphia: Lea and Febiger, 1947. $8.50.

This new edition of a standard treatise has been revised to include the knowledge gained during World War II. Decortication of the lung is discussed in some detail. Selected references are appended to each chapter, and a good index concludes the volume. The publishing is excellent in every way. The book is recommended for all medical libraries and to surgeons interested in the subject.

Principles of Occupational Therapy. Edited by Helen S. Willard, A.B., O.T.R., director, Philadelphia School of Occupational Therapy; and Clare S. Spackman, S.M. in Ed., O.T.R., director, curative workshop, Philadelphia School of Occupational Therapy, director, Occupational Therapy Department, Hospital of the Graduate School of Medicine, University of Pennsylvania, and assistant director, Philadelphia School of Occupational Therapy. 8°, cloth, 416 pp. with 46 illustrations. Philadelphia: J. B. Lippincott Company, 1947. $4.50.

This new textbook is the joint work of twenty specialists in the field of occupational therapy. The text is divided into two sections, basic concepts and applied principles. The first section deals with the history, development, scope, educational aims and activities of the subject, and factors in the organization of occupational-therapy departments. The second section discusses the place of the therapy in general and special hospitals, with a chapter on children's hospitals and pediatric services, and in United States Army and Navy hospitals during World War II. In this section there are chapters on the use of occupational therapy for patients with mental disease and tuberculosis, the visually handicapped and for patients with physical injuries. The last chapter of over a hundred pages is subdivided into three sections, dealing with treatment for limitation of motion of joints, flaccid paralysis and industrial injuries, for patients afflicted with cerebral palsy and for arthritic patients. The treatment is given in detail. The concluding chapter describes the rehabilitation program of the Veterans Administration. The work constitutes a treatise on the philosophy and practice of the subject. The text is well written, and the organization of the material is good. The volume is well published. The type is good and legible, and the printing, on a soft, light paper pleasing to the eye, is excellent. The book should be in all medical libraries and should prove valuable to all persons interested in physical therapy.

A Text-Book of Mental Deficiency (Amentia). By A. F. Tredgold, M.D., F.R.C.P., F.R.S. (Ed.), consulting physician to University College Hospital, London. Seventh edition. 8°, cloth, 534 pp., with 47 plates and 9 tables. Baltimore: Williams and Wilkins Company, 1947. $8.50.

This new edition of a standard textbook, last revised in 1937, has been brought up to date by the addition of considerable material. Some chapters have been rewritten, and the changes made by the British Education Act of 1944 relating to educationally subnormal and defective children have been incorporated in the chapter on English law concerning mental defectives. A good index concludes the volume. The text, printed in Great Britain, is well done with a good type on good paper. The book is recommended for all medical libraries and to all persons interested in the subject.

NOTICES

ANNOUNCEMENT

Dr. Franklin G. Balch, Jr., announces the removal of his office to 1180 Beacon Street, Brookline, for the practice of general surgery.

SUFFOLK DISTRICT MEDICAL SOCIETY

The Suffolk District Medical Society will meet in Sprague Hall, Boston Medical Library, 8 Fenway, Boston, on Tuesday, May 4. The councilors will meet at 3:30 p.m., and the annual meeting will be held at 5:00 p.m.

MASSACHUSETTS SOCIETY FOR SOCIAL HYGIENE

The annual meeting of the Massachusetts Society for Social Hygiene will be held at a dinner at the Boston City Club, 14 Somerset Street, Boston, on Wednesday, April 28, 6:00 p.m. *Guest speaker*: Dr. Raymond A. Vonderlehr of Atlanta, Georgia, medical director, Communicable Disease Center, United States Public Health Service, will speak on the subject "Past, Present and Future Responsibilities of the Social Hygiene Societies in the Control of the Venereal Diseases." Dr. William A. Hinton, chief of the Wassermann Laboratory, State Department of Public Health, and chief of the Laboratory Division of the Boston Dispensary, will be another guest of honor at the dinner. Dr. George Gilbert Smith will preside.

The public is cordially invited to attend. For details regarding the program, reservations for the dinner and so forth, application should be made in writing or by telephone to the office of the Massachusetts Society for Social Hygiene, 1145 Little Building, HAncock 6-3176.

NEW ENGLAND HEART ASSOCIATION

A meeting of the New England Heart Association will be held in the auditorium, Boston University School of Medicine, 80 East Concord Street, Boston, on Monday, April 26, at 8:15 p.m. Dr. James M. Faulkner will preside.

PROGRAM

Diphtheritic Myocarditis. Drs. Norman H. Boyer and Louis Weinstein.

Clinical and Laboratory Features of First Attacks of Rheumatic Fever Occurring in Scarlet-Fever Patients Treated with Penicillin. Drs. Louis Weinstein, Louis Bachrach and Norman H. Boyer.

Acceleration of Flow in the Veins of Human Limbs by the Local Application of Pressure. Drs. Joseph R. Stanton, Edward D. Freis and Robert W. Wilkins.

Some Observations Concerning the Effect of Sympathectomy on the Human Heart Rate. Drs. Reginald H. Smithwick, Earle M. Chapman, Dera Kinsey and George P. Whitelaw.

The Effects of Veratrum Viride in Hypertensive Man. Drs. Edward D. Freis, Joseph R. Stanton, James W. Culbertson, Julius Litter and Meyer H. Halperin.

Interested physicians and medical students are cordially invited to attend.

NEW ENGLAND SOCIETY OF PHYSICAL MEDICINE

The regular meeting of the New England Society of Physical Medicine will be held at the Ring Sanatorium and Hospital, Arlington, Massachusetts, on Wednesday, April 21, at 8 p.m. Dr. Volta R. Hall will speak on the topic "Physical Medicine in the Treatment of Psychiatric Conditions."

Members of the medical profession are cordially invited.

AMERICAN CLINICAL AND CLIMATOLOGICAL ASSOCIATION

The annual meeting of the American Clinical and Climatological Association will be held at White Sulphur Springs, West Virginia, from November 1 to 3 (secretary, James Bordley, III, M.D., Mary Imogene Bassett Hospital, Cooperstown, New York).

AMERICAN CONGRESS OF PHYSICAL MEDICINE

The twenty-sixth annual scientific and clinical session of the American Congress of Physical Medicine will be held from September 7 to 11, inclusive, at the Hotel Statler, Washington, D. C. Scientific and clinical sessions open to members of the medical profession in good standing with the American Medical Association will be given.

Full information may be obtained by application to the American Congress of Physical Medicine, 30 North Michigan Avenue, Chicago 2, Illinois.

AMERICAN NEUROLOGICAL ASSOCIATION

The annual meeting of the American Neurological Association will be held in Atlantic City, New Jersey, from June 14 to 16, with headquarters at the Claridge Hotel (secretary-treasurer, H. Houston Merritt, M.D., Montefiore Hospital, Gun Hill Road, New York 67, New York).

AMERICAN SOCIETY OF ANESTHESIOLOGISTS INC.

A joint meeting of the American Society of Anesthesiologists, Inc., and the Western Divisions of the Canadian Anaesthetists' Society will be held at the Hotel Saskatchewan, Regina, Saskatchewan, Canada, on April 23 and 24.

Physicians and medical students are invited.

MAINE MEDICAL ASSOCIATION

The annual meeting of the Maine Medical Association will be held in Poland Spring from June 20 to 22 (secretary, Frederick R. Carter, M.D., 142 High Street, Portland 3, Maine).

MINNESOTA STATE MEDICAL ASSOCIATION

The annual meeting of the Minnesota State Medical Association will be held in Minneapolis from June 7 to 9 (secretary, B. B. Souster, M.D., Lowry Medical Arts Building, St. Paul 2, Minnesota).

MONTANA STATE MEDICAL ASSOCIATION

The annual meeting of the Montana State Medical Association will be held in Billings on June 18 and 19 (secretary, H. T. Caraway, M.D., 115 North 28th Street, Billings, Montana).

NEW MEXICO MEDICAL SOCIETY

The annual meeting of the New Mexico Medical Society will be held in Las Vegas from June 3 to 5 (secretary, H. L. January, M.D., 221 West Central Avenue, Albuquerque, New Mexico).

(Notices concluded on page xiii)